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Mapping aggressive behavior of forensic psychiatric inpatients with self-report and structured staff-monitoring☆

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ABSTRACT

Structured assessment of aggressive behavior in forensic psychiatry is needed. This study investigated staff-observed and self-reported measures to map prevalence and characteristics of aggressive behavior in forensic inpatients and aimed to identify early signs of aggressive outbursts. In this longitudinal study, 120 forensic psychiatric inpatients with a history of aggression were included. Staff monitored aggressive behavior for 30 weeks using the Social Dysfunction and Aggression Scale (SDAS). Patients completed baseline self-report measures on aggression, anger, and impulsivity. Staff monitoring showed that most inpatients displayed moderate (86%) or severe (65%) aggressive behavior at least once, and 37.5% showed physical aggression. Inpatients with a least one physical aggression incident differed from others in self-reported anger, (reactive) aggression, non-planning impulsivity, and sociodemographic and clinical characteristics (e.g., higher prevalence of cluster B personality disorders, and lower intelligence). Two-thirds of the physical aggression incidents were preceded by observations of increased non-physical aggression (SDAS). In forensic psychiatric inpatients with a history of aggression, more than a third of the patients demonstrated at least one occasion of physical aggression during 30 weeks of observation.

Treating aggressive behavior of forensic psychiatric inpatients is a major challenge (e.g., Bader and Evans, 2015). Inpatients admitted to a highly secured forensic psychiatric center (FPC) in the Netherlands, often suffer from one or more psychiatric disorder(s) underlying the crime committed. Many have a history of childhood trauma and most of them are admitted for a violent offense. Furthermore, in the Dutch system, forensic inpatients have been involuntarily assigned by the court to an FPC and stay on wards with other patients with similar criminal and psychiatric backgrounds. Inpatients have limited autonomy concerning activities or walking around within the FPC. Due to the aggression problems of most inpatients, an FPC can be an unsafe environment for all individuals working or residing in that environment (Schuringa et al., 2019).

Aggressive behavior among inpatients toward professionals working in FPC is common, ranging from threatening verbal or physical behavior to actual physical aggression inflicting harm to others, self, or property

(Bowers et al., 2011; Nicholls et al., 2009; Nijman et al., 2005). Moreover, aggressive behavior has severe negative consequences for treatment progress, and the emotional and physical well-being of staff and patients (Rossberg and Friis, 2003). Staff working in forensic mental health settings are at higher risk of becoming a victim because of the larger proportion of inpatient violence compared to those in general acute settings (Bowers et al., 2011). Despite the negative consequences of inpatient aggression in forensic psychiatry, this topic has received relatively little research attention (Hogan and Olver, 2016). Therefore, there is a continuing need to study and understand how to adequately monitor, manage, predict and treat inpatient aggression.

The behavior of forensic inpatients is continuously monitored by staff and risk assessments are performed to estimate and monitor the likelihood of inpatient aggression (Schuringa et al., 2014). However, despite the increase in structured measurements, the clinical reality is still that most observations are unstructured with the danger of marginal

scoring integrity. This can adversely influence the accuracy of the measurements and thus, presumably, the assessments and management strategies that are based on these observations (Kobes et al., 2012). These mainly unstructured observations also limit the ability to provide a clear overview of the frequency and severity of aggressive behavior in forensic psychiatry, which might partly explain why the reported prevalence rates of inpatient aggressive behaviors vary widely (8-44%; Dack et al., 2013).

Structured staff observations of inpatient aggression as an alternative to unstructured observations can provide a more complete, in-depth, and period-based assessment of the frequency and severity of inpatient aggression. Some examples of instruments are the Overt Aggression Scale (OAS; see Silver and Yudofsky, 1991; Yudofsky et al., 1986), the modified version of the OAS for use in outpatients (OAS-M; Coccaro et al., 1991; Coccaro, 2020), the Staff Observation Aggression Scale-Revised (SOAS-R; Nijman et al., 1999), and the Social Dysfunction and Aggression Scale (SDAS; Wistedt et al., 1990). An advantage of the SDAS compared to incident registration with, for example, the SOAS-R is the weekly routinely scoring that makes this instrument independent of the subjective judgment of the staff whether a particular incident is serious enough to be documented. In a large study (N = 199) comparing several observation scales, the SDAS was recommended as a useful tool to assess a broad spectrum of aggressive behavior. In general, inpatient aggressive behavior is rarely a single incident and is usually characterized by a wide range of (non-)verbal behavioral patterns (Steinert et al., 2000). Thus, the SDAS may aid in the assessment and management of inpatient aggression.

In addition to structured staff observations, it is important to predict inpatient aggression. Predicting aggression in the short term is especially important in forensic psychiatry because it allows staff to implement early interventions that can prevent escalation (Hvidhjelm et al., 2014). An example of an instrument used to predict short-term inpatient violence is the Brøset Violence Checklist (BVC). The BVC was developed in Norway (Almvik et al., 2002; Woods et al., 2000), and a study in a Danish forensic psychiatric setting showed that the BVC had satisfactory specificity (0.997) and sensitivity (0.656) as a predictor of the short-term risk of inpatient violence (Hvidhjelm et al., 2014). The advantage of the BVC is that it is a short six-item rating scale that can be integrated into the daily routine. However, a disadvantage is that the symptoms are scored dichotomously as present or absent, so there is no room for gradations.

Although the SDAS is considered a clinical useful instrument, staff observations have several limitations, such as accepting, downsizing, or 'normalizing' aggressive behaviors, which may be due to getting used to aggressive behavior. Previous research suggested that routine incident reports might be biased, due to inconsistency and under-reporting (Dickens et al., 2013). Besides, some behaviors remain unobserved because the staff is unable to monitor patients 24/7. Therefore, self-report measurements are likely to offer additional information. Self-report measurements can be easily administered, and provide insight into patients' subjective experiences, thoughts, feelings, and behaviors (Demetriou et al., 2015). Moreover, self-report questionnaires for impulsivity (e.g., the Barratt Impulsiveness Scale-11 (BIS-11; Stanford et al., 2009), and anger (e.g., the Novaco Anger Scale and Provocation Index (NAS-PI; Hornsveld et al., 2011, Novaco, 2003) have previously been used to identify patients at risk for future inpatient violence (Hornsveld et al., 2011; Stanford et al., 2009). Validation of the NAS-PI in a Danish (non-)clinical and offender sample highlighted that higher scores on NAS increased the risk of aggressive behavior in the future (Moeller et al., 2016). Within forensic psychiatry, certain validity problems are to be expected with self-report questionnaires, as forensic inpatients often have no insight into their mental illness and tend to provide socially desirable answers to avoid potentially negative (legal) consequences (Kobes et al., 2012). Taken together, the current evidence-based practice suggests that a combination of self-and-staff-reported aggressive behaviors is likely to provide a more complete and reliable overview of both the prevalence and characteristics of inpatient aggression.

Apart from observation and self-report measures, patient characteristics should also be taken into account. A meta-analysis by Dack et al. (2013) compared aggressive inpatients and non-aggressive inpatients. For example, aggressive patients are younger, male, have a history of violence, are more likely to be diagnosed with schizophrenia, and are more likely to be hospitalized involuntarily. The latter characteristic is inevitable for forensic psychiatric inpatients residing in an FPC in the Netherlands. This meta-analysis also showed that the associations between aggression and characteristics of inpatients were small, implying that other factors are likely to be involved in adequately predicting aggressive behavior (Dack et al., 2013). One of the included studies was a 7-year longitudinal study conducted in Italy, which found that factors such as, duration and number of previous admissions were more predictive than diagnosis or commitment status (Grassi et al., 2006). Interestingly, many of these factors can be discovered before admission and can be derived from file information.

1.1. Aims and objectives

The aim of the current study was the observation and registration of aggression weekly. Furthermore, we were interested if weekly structured monitoring of aggressive behavior would be informative in the detection of early signals of mild aggression before (severe) physical aggression, therefore we selected the SDAS. The objectives of this longitudinal follow-up study among forensic psychiatric inpatients were, first, to map the characteristics and prevalence of aggressive behaviors during their stay in FPCs utilizing long-term structured staff observations and self-report measures, and to investigate sociodemographic and clinical differences between physically aggressive versus non-physically-aggressive inpatients. Second, we aimed to determine whether severe incidents of physical aggression were preceded by the staff-observed mild or moderate aggressive behavior of the patient one (or two) week(s) before the incident.

2. Methods

2.1. Participants

Study participants were all male forensic psychiatric inpatients with a history of aggression and current clinical problems with reactive aggressive behavior. Thus, all participants had a previous conviction for aggression and/or were admitted to the FPC for a violent offense. These patients stayed in one of the four participating FPCs in the Netherlands. In these FPCs, there were no differences concerning research procedure and the scoring of the SDAS, but the FPCs differed in registration policies around incidents. The current study is part of a larger multicenter randomized controlled study on the effectiveness of a Virtual Reality Aggression Prevention Training (VRAPT). The design and study protocol are described in detail elsewhere (Tuente et al., 2018). To be included in the current study, SDAS data had to be available for at least 30 weeks for all participants. Inclusion criteria were being a forensic psychiatric inpatient, and a history of aggression and current clinical problems with reactive aggression as assessed by their treatment supervisor (i.e., a licensed psychologist or psychiatrist).

2.2. Design and procedure

Potential participants were informed about the study by their treatment supervisor. If patients were considered eligible to participate, an independent research assistant who provided them with oral information and a written information letter and informed consent form, visited them. After informed consent was obtained, the staff was trained in the procedure of scoring the SDAS and instructed how to observe participants' behaviors on the ward to optimize SDAS scoring integrity. Staff

completed the SDAS weekly during a 30-week observation period for all included participants. All staff members involved also completed at least two SDAS lists together with the first author or a research assistant. On three out of four sites, the participant's mentor(s) was responsible for adequately scoring the SDAS weekly. In one FPC, the staff conducted the SDAS together with the whole team during the weekly staff meetings. Staff working on the wards in the Netherlands are sociotherapists with different cultural, social, and educational backgrounds (at least a relevant bachelor's degree preferably in the field of Social Work, Pedagogy, or Psychology). More detailed information (e.g., age, gender) of the staff members involved in the scoring was not collected. Baseline characteristics and demographic information, such as age, intelligence, and DSM-5 diagnoses of mental disorders were collected from (electronic) patient files. Self-report questionnaires were completed at the beginning of the SDAS observation period. This study was approved by the medical ethical board of the University Medical Centre Groningen, Groningen (number: NL52939.042.15) and was conducted according to the Declaration of Helsinki. The study was registered in the Dutch Trial Register (NTR, TC = 6340).

2.3. Measures

2.3.1. Social dysfunction and aggression scale (SDAS)

The SDAS (Kobes et al., 2012; Wistedt et al., 1990) is a structured observation checklist of a broad range of mild to severe forms of verbal and non-verbal aggressive behaviors. In the current study, the nine-item version was used because VRAPT aimed to reduce aggressive behavior towards others. Therefore, in the context of the RCT, the items on self-directed aggression (suicidal and self-injurious behavior) were less relevant. The nine SDAS-items were scored by staff on a 5-point scale ranging from absent (0) to severely present (4). The SDAS consists of six non-physical aggressive items and three physical aggressive items. All SDAS items were scored in two ways, first for the most severe aggressive behaviors in the previous week (peak), and second for the average level of aggressive behaviors in the previous week (general). Research assistants collected SDAS data from the ward staff every week. When the SDAS was not completed after two weeks, research assistants completed the SDAS form retrospectively based on available patient file information. In total, 91.4% (n = 3291) of the total 3600 SDAS forms were completed by the staff within two weeks. For only two out of 3600 SDAS forms, no SDAS total peak score could be calculated due to missing items in that week. A peak score of at least three (i.e., moderate) on one of the three physical aggression SDAS items (physical violence to personnel; physical violence to others, not personnel; physical violence to things) was used to classify participants in a physically aggressive or non-physically aggressive group.

2.3.2. Aggression questionnaire, Dutch version (AVL)

Participants completed the Dutch version of the Aggression Questionnaire (Meesters et al., 1996). This questionnaire assessed four subscales of aggression, i.e., physical aggression, verbal aggression, anger, and hostility (Buss and Perry, 1992). Cronbach's α of the subscales and the total score in this study were physical aggression .85; verbal aggression .47; anger .69; hostility .77; total .89.

2.3.3. Reactive-proactive questionnaire (RPQ)

The RPQ was used as a self-report questionnaire to measure reactive and proactive aggression. The RPQ questions the type and motivation of aggressive behavior and refers to this behavior in general (Domburgh and Popma, 2003). Cronbach's α of the subscales and the total score in this study were proactive aggression .87; reactive aggression .86; total .92.

2.3.4. Novaco anger scale (NAS)

The NAS is a self-report questionnaire designed to assess anger as a problem of psychological functioning and physical health and to assess

therapeutic change (Hornsveld et al., 2011). This questionnaire is a two-part test of 73 items and has three subscales; Cognition, Arousal, and Behavior (Hornsveld et al., 2011). Cronbach's α of the subscales and the total score in this study were cognition .77; arousal .86; behavior .89; total .94.

2.3.5. Barratt impulsiveness scale (BIS-11)

The BIS-11 is a 30-item questionnaire to investigate impulse control (Patton et al., 1995; Reise et al., 2013). The BIS-11 consists of three subscales: Attentional impulsiveness, Non-planning impulsiveness, and Motor impulsiveness. Cronbach's α of the subscales and the total score in this study were motor .68; cognitive .60; non-planning .78; total .86.

2.4. Statistical analyses

Data were analyzed using SPSS version 23.0, and sub-group analyses were performed with Stata version 14. Significance was accepted at $p \leq 0.05$. First, the total SDAS peak scores for the 30-week observation period were displayed for each participant in a heatmap. The intensity of the color is a visualization of the patterns and peaks of observed aggressive behavior during the observation period. Second, descriptive analyses were performed for demographic and clinical characteristics, offense history, and index offense. The physically aggressive and non-physically aggressive groups were compared on demographic characteristics with the Independent sample t-tests, the Mann-Whitney U tests, and the χ^2 test. Third, both groups (physically aggressive versus non-physically aggressive inpatients) were compared on self-reported aggression, anger, and impulsivity using the Independent sample t-tests. Values were missing on several self-report questionnaires, e.g., due to unwillingness to answer some questions. Subscales and total scores were still computed if one missing value was present in a scale with less than 10 items. For subscales with more than 10 items, two missing values were allowed. Fourth, sub-group analyses using multilevel logistic regression analyses were performed on the 45 participants involved in at least one physical aggressive incident as measured by the SDAS during the 30-week observation period (e.g., Sommet and Morselli, 2017). Assumptions for multilevel analyses were checked. Multilevel analyses were performed as the data had a hierarchical structure; that is, repeated measures (level 1) nested within individuals (level 2). In this model, the presence of physical aggression was the dependent variable (0 absent, 1 present), and the total peak scores of the physical (three items) and the non-physical (six items) aggression subscales of the previous weeks were used as predictors.

3. Results

3.1. Descriptives

Thirty weeks of SDAS data were collected from 120 inpatients. Data were missing on self-report questionnaires because some participants refused to complete these questionnaires: AQ (N = 10), BIS-11 (N = 10), NAS (N = 10), RPQ (N = 11), and CTQ-SF (N = 11).

As shown in Fig. 1, most of the participants had an elevated SDAS score at least once during the 30-week follow-up period. Eighty-six percent (N = 103) had at least one score $\geq$ of 3 on any of the items, and 65% (N = 78) a score of 4, indicating severe aggression. In total, 37.5% (N = 45) of the included inpatients engaged in physically aggressive behavior (i.e., at least once a score of three or four on one of the three physical aggression items). The physically aggressive incidents are marked with an '•' in the heatmap (Fig. 1). The heatmap (Fig. 1) provides an overview and visualization of the prevalence of inpatient aggression. Furthermore, the heatmap shows that several participants showed almost continuous aggressive behavior during the observation period, while for other participants; it was just a single incident. Of the 45 patients who were physically aggressive during the follow-up, 24 (53.3%) were physically aggressive only during one week and 18
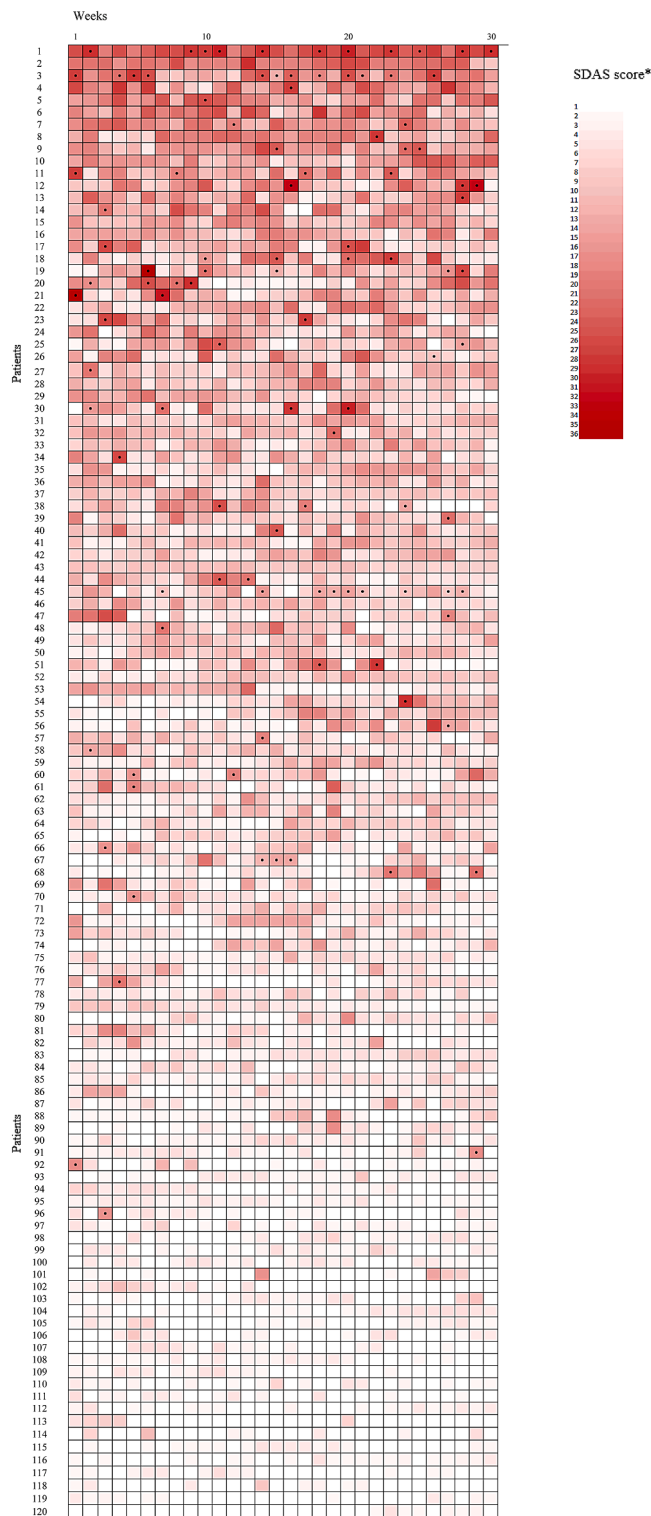
Fig. 1. * Legenda of the heatmap, the 9 items of the SDAS were rated every week on a five-point scale ranging from 0-4. This results in a minimum SDAS peak score of 0 and a maximum score of 36 for every week.

** The "●" in the table indicates a score of 3 or higher on one of the three physical aggression items of the SDAS.

Heatmap of weekly SDAS peak scores by the participant, ordered by the severity of aggressive behavior (N = 120).

patients (40%) had between two to five weeks in which they had at least one act of physical aggression. A small number of inpatients (N = 3; 6.7%) were physically aggressive at least once for nine weeks or more. The mean SDAS scores can be found in Table 1.

There were several statistically significant differences in socio-demographic and clinical characteristics between physically aggressive and non-physically aggressive inpatients, see Table 2. Inpatients who engaged in physically aggressive behaviors were on average almost five years younger (p < .01), and more often diagnosed with cluster B personality disorder (p = .05), attention disorders (p = .03), and were less likely to have a sexual disorder (p = .04) compared to the non-physically aggressive inpatients. The physically aggressive inpatient patients had lower intelligence (p = .05) and in terms of index offenses they committed (attempted) murders less often, but more often other violent index offenses (p = .01) compared to the non-physically aggressive inpatients. There were no statistically significant differences between groups regarding damage to the victim of index offense and childhood trauma.

3.2. Group differences in self-report physical aggression and self-reported aggression, anger, and impulsivity

Participants who engaged in at least one physically aggressive incident during the 30-week follow-up period reported significantly higher aggression scores on the AQ, including the subscales physical and verbal aggression, anger, and hostility, compared to non-physically aggressive participants. Furthermore, they also reported higher levels of reactive aggression on the RPQ. Reported anger was in the physical aggressive group also higher for the NAS total score, and the subscales behavior and cognition. No significant differences in impulsivity were demonstrated between both groups, except for the subscale Nonplanning. For further details, see Table 3.

3.3. Prediction of physical aggressive incidents

We performed subgroup analyses on the 45 participants who were severely physically aggressive at least once during the 30-week follow-up period. As shown in Table 4, participants involved in a physically aggressive incident had significantly higher peak scores on non-physical aggression one week before the incident as measured with the SDAS. One-third (36 of the 108) of the physical incidents were not preceded by higher scores (i.e., ≥ 3) on individual SDAS items. The other two-thirds were preceded a week before the incident by higher scores on SDAS verbal aggression (30.2%, item 1 and 2), irritability (20.6%, item 3), and dysphoric mood (20.2%, item 5). There was a trend effect for non-physical aggression two weeks before the incident. Total peak physical aggressive behavior one or two-week(s) prior did not predict any physical aggressive incidents.

4. Discussion

This was a longitudinal study of 120 forensic psychiatric inpatients

Table 1
SDAS means.

	Physical aggressive (N = 45)			Non-physical aggressive (N = 75)		
	Mean	(sd)	Range		Mean	(sd)	Range	
SDAS peak physical	0.6	0.8	0.1	4.7	0.1	0.5	0.0	3.5
SDAS general physical	0.3	0.5	0.0	3.1	0.1	0.3	0.0	2.6
SDAS peak non-physical	9.0	4.2	1.5	20.5	4.7	3.7	0.4	16.2
SDAS general non-physical	5.2	3.0	0.5	11.9	2.8	2.7	0.0	9.7

Table 2
Baseline characteristics (N = 120).
Data are n (%) or mean (SD)

	Physically aggressive (N = 45)		Non-physically aggressive (N = 75)		p
Age, years	35.2	8.5	40.8	10.9	.004
Non-Dutch origin	9	20.0	19	25.3	.50
DSM-IV diagnosis*					
Psychotic disorders	15	33.3	23	30.7	.76
Cluster B personality disorders	24	53.3	26	34.7	.05
Cluster C personality disorders	none	none	2	2.7	.27
Personality disorder NOS	17	37.8	33	44.0	.50
Autism	7	15.6	9	12.0	.58
Attention disorders	10	22.2	6	8.0	.03
Sexual disorders (pedophilia, paraphilia)	1	2.2	10	13.3	.04
Intelligence (IQ)					.05
Total IQ < 90	29	64.4	34	45.3	
Total IQ > 90	14	31.1	28	37.3	
Missing IQ score	2	4.4	13	17.3	
Type of index offense*					.01
(Attempted) homicide	13	28.9	38	50.7	
Sexual offense	9	20.0	19	25.3	
Violent offense	21	46.7	16	21.3	
Property offense	none	none	1	1.3	
Arson	2	4.4	none	none	
Missing	none	none	1	1.3	
Victim consequences of index offense*					.06
No injury	6	13.3	10	13.3	
Physical injury	28	62.2	39	52.0	
Deadly injury	1	2.2	16	21.3	
Material damage	6	13.3	4	5.3	
Psychological neglect	none	none	1	1.3	
Missing	4	8.9	5	6.7	
Childhood trauma (CTQ-SF)	(N = 40)		(N = 69)		
CTQ-SF total	55.8	22.6	52.3	19.8	n.s.
Emotional Abuse	12.2	6.0	10.7	5.4	n.s.
Emotional Neglect	12.7	5.8	13.4	5.7	n.s.
Phyical Abuse	11.5	6.7	10.0	6.4	n.s.
Phyical Neglect	11.8	3.4	10.4	2.8	n.s.
Sexual Abuse	8.3	5.2	7.9	5.7	n.s.

*These variables do not add to 100%, as there is overlap between diagnoses and types of offenses committed by the same person.

Table 3
Self-report questionnaires.

	Physically aggressive		Non-physically aggressive		P		
Self-reported aggression (AVL)	90.9	15.1	77.7	18.9	t (108) = 3.78		<.001
Physical Aggression	31.8	5.7	25.6	9.0	t (109) = 2.95		<.001
Verbal Aggression	15.8	2.5	14.6	3.1	t (109) = 2.14		.04
Anger	20.5	4.5	17.0	5.3	t (108) = 3.53		.001
Hostility	23.0	6.3	20.5	6.5	t (108) = 1.97		.05
Reactive/Proactive aggression (RPQ)	22.3	6.9	16.8	10.3	t (107) = 2.97		<.01
Proactive aggression'	9.1	5.1	7.0	5.6	t (107) = 1.91		.06
Reactive aggression	13.4	3.1	9.9	5.3	t (107) = 3.85		<.001
Anger (NAS)	91.6	13.5	84.7	16.7	t (108) = 2.25		.03
Cognition	32.5	4.3	30.2	5.1	t (108) = 2.48		.02
Arousal	29.8	5.1	28.1	6.1	t (108) = 1.45		.15
Behavior	29.3	5.6	26.4	6.8	t (108) = 2.30		.02
Impulsivity (BIS-11)	66.1	10.9	61.6	12.1	t (108) = 1.93		.06
Motor	23.5	5.1	22.0	4.2	t (108) = 1.76		.08
Cognitive	16.2	4.1	15.6	3.9	t (108) = 0.80		.42
Nonplanning	26.3	4.8	24.1	5.8	t (108) = 2.09		.04

Table 4
Prediction of physical aggression by SDAS scores in the weeks before aggressive incidents.

SDAS	z	P	SE	95% CI		OR
1 week before the incident						
Peak aggression physical	1.63	.10	.08	.98	1.27	1.12
Peak aggression non-physical	2.07	.04	.02	1.00	1.08	1.04

	z	p	SE	95% CI		OR
2 weeks before the incident						
Peak aggression physical	-0,67	.50	.08	.80	1.12	.94
Peak aggression non-physical	1.79	.07	.02	1.00	1.08	1.04

who stayed in four FPCs in the Netherlands, mapping aggressive behavior with self-report measures and 30 weeks of staff observation. In the current sample of forensic psychiatric inpatients with a history of aggression, aggression was confirmed to be common, with 86% of the inpatients showing at least once an act of moderate aggression (defined as short outbursts of aggressive talking; or repeated episodes of throwing trivial things, hitting objects, or slamming doors). Besides, 65% of the included patients had at least one act of severe aggressive behavior, for example: ostentatious in opposing the rules of social interaction; being completely uncooperative; the patient has dangerously assaulted a member of staff; or is making serious insults and/or wishing people harm. More than one-third of the included inpatients (37.5%) displayed physical aggression at least once during the 30 weeks follow-up period. Concerning the prevalence of aggressive behavior, our findings are in line with previous research (Dack et al., 2013; Hildebrand et al., 2004; Verstegen et al., 2017). Patients who exhibited physical aggression during the follow-up period showed higher scores on anger, hostility, reactive aggression, and non-planning impulsivity at baseline than non-physically aggressive patients. In two-thirds of physical aggression incidents, irritability and dysphoric mood were already observed by the staff in the week before the incident. Thus, higher levels of observed non-physical aggression were indicators of physically aggressive behavior a week later.

Consistent with the literature, our study supports the notion that self-report measures may be useful to identify high-risk individuals in an inpatient setting (McDermott et al., 2008). This is interesting since self-report questionnaires are relatively easy and cheap to administer and interpret. Although the use of self-report questionnaires in forensic settings is debatable because of socially desirable answers and non-response, this is not immediately apparent from our study. Participants in the current study reported a wide range of anger, impulsivity, and aggressive behaviors. Considering psychiatric diagnoses, both attention disorders and cluster B personality disorders were more common among individuals who exhibited physical aggression. These findings confirm our hypothesis because ADHD and cluster B personality disorders both are within the externalizing spectrum disorders (Krueger and Tackett, 2014). In the prediction analyses, we only included the SDAS because we wanted to investigate whether there were visible triggers that staff noticed before the incident occurred. We were interested in whether visible signs of increasing aggression preceded physically aggressive incidents, because if so, it may have important clinical implications in the prevention of inpatient aggression by implementing

more adequate goal-directed de-escalation techniques.

Much research in forensic psychiatric settings focuses on the prediction of future violence using structured risk assessment tools, such as the Violence Risk Appraisal Guide (VRAG; Quinsey et al., 1998), the Level of Service Inventory-Revised (LSI-R; Andrews & Bonta, 2001) and the HCR-20[V3] (Douglas et al., 2013) for medium- and long-term prediction of violence risk; and the BVC for prediction of immediate violence risk. However, using self-report measures to improve the accuracy of these assessments is less extensively studied (McDermott et al., 2008; Schuringa et al., 2019). Using self-report questionnaires in combination with structured violence risk assessments, a clearer picture of the individual's aggressive behaviors, and the early warning signs of an increased risk of aggression, may be given. The current study confirms previous findings that self-report measures may be useful in identifying individuals at high risk for inpatient aggressive behavior (McDermott et al., 2008). However, the question is to what extent the self-reported questionnaires are useful for monitoring aggressive behavior, since not all measures may be sensitive for change over time. For instance, the AQ includes items such as: "*I have threatened people I know*" and "*There are people who pushed me so far that we came to blow*", where the patient responds without a given period.

Another finding with clinical implications was that most incidents of physical aggression occurred with prior warning signs. The fact that the patients display early warning signs that can be observed before aggressive behaviors may be important to improve safety on the wards. It is well known that forensic psychiatric patients residing in forensic psychiatric care often have difficulties managing their feelings of anger, impulsiveness, and often have insufficient skills to handle conflicts (Daffern et al., 2007). Besides, on an average ward, 12 patients share a space with individuals they would not normally spend time with. This patient density increases the risk of aggressive behavior, since conflicts easily may arise (Dexter and Vitacco, 2020). Furthermore, it is important to note that aggressive behavior in forensic psychiatry is more tolerated than outside forensic psychiatric care in the general community, something that has been demonstrated to contribute to pro-aggressive thoughts, attitudes, and behavior (Daffern et al., 2007). Therefore, forensic inpatients may use aggressive behaviors without realizing that the behavior is perceived as very aggressive by others, such as staff and fellow patients. Accordingly, staff turnover, shortages of adequate staff, and overcrowding of inpatients implement interventions to prevent, assess and treat aggression difficult (Dexter and Vitacco, 2020). Furthermore, normalization makes it more difficult to prevent aggression, because mild forms of aggression are usually not detected. However, in our study, we see that mild forms of aggression often precede physical aggression.

Physical aggression measured with the SDAS was predicted by increased scores on verbal aggression, irritability, and dysphoric mood one week before the incident. These results confirm the findings of a meta-analysis that highlighted behavioral cues, such as attention-seeking behavior, boisterousness, and/or increased motor activity, are commonly reported antecedents of aggressive incidents (Papadopoulos et al., 2012). Physical aggressive incidents often occur in a context with individuals who cannot cope with negative feelings, disappointments, or rejections (e.g., withdrawal from tobacco, not allowed to make a phone call; Bousardt et al., 2016). Although it is not surprising that agitated mood or increased irritability provoke aggressive incidents, these findings may provide guidelines for staff to recognize signs of immanent physical aggression. Consequently, early recognition of triggers can potentially increase prevention, for example, by improving staff-patient interactions (Papadopoulos et al., 2012).

Staff members have a real (or perceived) degree of control and power over inpatients (e.g., Papadopoulos et al., 2012). The largest burden of living in an FPC is living with limited autonomy since staff decides when you wake up, eat, work and sleep. Therefore, a possible solution may be to reduce the actual (or perceived) power of staff, for example, to give patients more freedom and autonomy when planning their daily life

within an FPC (Papadopoulos et al., 2012). Nevertheless, this will be a challenging solution, due to cutbacks in forensic psychiatric care in the Netherlands, which creates a sobering environment for both staff and patients. However, effectively pre-empting physical aggression may also depend on the ability of the staff to not only recognize but to intervene adequately and on time. The most frequently implemented de-escalation techniques by staff members are an arrangement of facilities, medication, and verbal interactions, such as talking to the individual and trying to understand what has triggered him (Kuivalainen et al., 2017; Papadopoulos et al., 2012). Yet, whether these techniques are effective has not been investigated systematically. As is evident from the heatmap (Fig. 1), some patients may, to a certain extent, be in a more or less constant state of agitation, whereas others have only a single event of physically aggressive behavior. Therefore, it is important that staff adequately notice changes in the behavioral pattern of each patient and are aware of specific triggers, as they may vary between patients.

From a broader perspective, knowledge about the causes and consequences of aggression has increased in recent years. However, translating and integrating these theories into aggression treatment is not yet standard practice (Gilbert and Daffern, 2010). Effective aggression regulation treatments are highly needed, however, there is a lack of evidence-based interventions in forensic psychiatry. Many treatments in forensic psychiatry have not been formally evaluated, and efficacy is often assumed based on resemblance with other established treatment programs and principles (Papalia et al., 2019). Moreover, results of previous randomized controlled trials on the effectiveness of aggression regulation treatments are promising but inconclusive and limited due to the small number of controlled studies (Papalia et al., 2019; Ross et al., 2013). Furthermore, most treatment trajectories in forensic psychiatry have a long duration, and due to this drop-out rates are high (Hornsveld et al., 2008). All these issues highlight the fact that treatment of forensic psychiatric inpatients is challenging (Kip et al., 2018). Virtual Reality (VR) may offer a solution to let patients learn and practice new behavior in a controlled, realistic, safe, and personalized environment. Because of this, a novel Virtual Reality Aggression Prevention Training (VRAPT) targeting social information processing constructs has been developed to reduce aggressive behavior of forensic psychiatric inpatients (Tuente et al., 2018).

4.1. Strengths and limitations

A major strength of this study was that it was a multicenter study with a relatively large sample: 120 forensic psychiatric inpatients were included within two years, which entails 8.6% of the total male forensic inpatient population of the Netherlands (*ForZo in getal 2013-2017,* 2018). Another strength is the follow-up period of 30 consecutive weeks of staff reports, which provides a clear overview of patients' aggressive behaviors. Moreover, this study combined self-report and staff-observed aggressive behavior measurements to provide a more complete picture of inpatient aggressive behaviors. The four participating FPCs were instructed to use the structured SDAS measure for staff observations. The implementation of the SDAS in all centers enabled us to combine and compare findings on the same observation measure for the first time, as FPCs used to have their method to register and report aggressive behavior, which is usually unstructured.

Our study also had several limitations. First, the SDAS was scored by a single staff member, usually the mentor, and every week. Having multiple raters can increase reliability, and staff members can reach a consensus on the scoring of the items. Furthermore, because the staff works in shifts, in some cases, the mentor had to rely on reports from colleagues. However, in one of the four centers, the SDAS was completed with the entire team at their weekly meeting. Second, there was a selection bias embedded in the design, as only inpatients having (a history of) problems with reactive aggression and who were motivated for aggression treatment were included. In practice, some severely aggressive individuals refused to participate because they denied having

problems with aggressive behaviors. Taken together, these limitations restrict the generalizability of the findings. Third, 9% of the SDAS has been rated afterward; however, these ratings were made on patient file data that were considered reliable in the clinical setting. Fourth, subgroup analyses were done on a small group (N = 45) since there were only 45 inpatients involved in physically aggressive behavior during the observation period. Fifth, the information on the physical aggression incidents was limited in this study. We only had a score of 3 or 4 on one of the three physical aggression items of the SDAS, but no further information, for example on injuries of the victim. In the future, it would be helpful to collect information that is more detailed on the incidents.

4.2. Clinical implications and recommendations for future research

These findings have several clinical implications for understanding and mapping aggressive behavior. First, inpatients involved in physically aggressive behavior were more likely to have a Cluster B personality disorder, attention deficit disorder, and/or lower intelligence. This information can be derived from file information, and therefore, it is of great importance to study this association between diagnosis and inpatient aggressive behavior in more detail. Based on this information a pre-risk assessment can be made before admission to an FPC. This can help clinicians and ward staff to decide on the most suitable ward and in the design of the treatment plan. Although treatment in forensic psychiatry is mainly focused on rehabilitation, preventing reoffending, and reducing risk factors (e.g., aggressive behavior), the current study shows that aggressive behavior is still common, even in this highly secured environment. More insight into this behavior can contribute to the further development of treatment methods, such as schema therapy and/or aggression therapy.

Second, the SDAS seems to be a useful instrument to monitor aggressive behavior in a high-security forensic inpatient setting. The SDAS is relatively easy to administer, and even after this study was finished, several individuals working in the participating FPCs continued using the SDAS to observe and map the (aggressive) behavior of the inpatients. Using the SDAS weekly may not only be informative for the ward staff but can probably also help in early prevention. Third, the issue of scores on the self-report questionnaires amplified the use of self-report questionnaires in inpatient settings is an intriguing one, which could be usefully explored, in further research. However, it is unclear to what extent these self-report questionnaires are sensitive enough to measure (clinical) change over time. This research has thrown up many questions in need of further investigation. Therefore, more research using larger samples is needed to focus on the implementation of the SDAS combined with self-report questionnaires. More broadly, research is also needed to determine whether implementing self-report questionnaires to predict future aggressive behavior is feasible.

Conclusions

The findings in our study provide insights into the prevalence and patterns of aggressive behavior in FPCs. Almost one-third of the included inpatients engaged at least once in a physically aggressive incident during the 30-week observation period. The mean SDAS scores showed that aggressive behaviors are relatively common in such a population. Furthermore, the results suggest that structured and weekly monitoring of behavior by staff may be used to detect early signs of physically aggressive behavior. Especially increased verbal aggression, irritability, and a dysphoric mood were indicators of subsequent physical aggressive behavior. In line with previous research, self-report questionnaires and clinical characteristics can identify individuals at high risk for inpatient physical aggression. However, more research on the sensitivity and specificity of the included self-report questionnaires is warranted, before they can be used to monitor aggressive behavior.

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