The Brøset Violence Checklist (BVC) assesses confusion, irritability, boisterousness, verbal threats, physical threats, and attacks on objects as either present or absent. It is hypothesized that an individual displaying two or more of these behaviors is more likely to be violent in the next 24-hour period. All 109 consecutive referrals to four psychiatric in-patient acute units during a 2-month period were included in the study. Ratings were performed at the time of admission and three times a day for each patient—once for each working shift. Interrater reliability was adequate. Thirty-four separate incidences of violence occurred. Comparisons between ratings performed in the 24-hour interval before the incident, and all other ratings suggested moderate sensitivity and good specificity of the instrument. It is concluded that the BVC is a useful instrument in predicting violence within the next 24-hour period and that the psychometric properties of the instrument are satisfactory.

The Brøset Violence Checklist

Sensitivity, Specificity, and Interrater Reliability

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Management of violent behavior among psychiatric patients constitutes a major challenge in psychiatric hospital units because it destroys the therapeutic climate, upsets fellow patients, demoralizes staff, and sometimes results in fatal damage. The need for predictive methods of identification of violent individuals on the part of those who may be subjected to the violence is reflected in the growing number of prediction studies over the past few decades. Violence is common in mainstream psychiatric settings, that is, acute and short-term wards, with injuries, stress, anxiety, and even psychosomatic illness being reported as the result of exposure to violent inpatients (Berg, Olsen, Sveipe, & Hoy, 1994). Benjaminsen and Kjærbo (1997) found that more than 90% of doctors and nurses working in psychiatric hospitals have been subjected to violence from patients at some time during their career. Furthermore, it has also been reported that violent behavior among

JOURNAL OF INTERPERSONAL VIOLENCE, Vol. 15 No. 12, December 2000 1284-1296

psychiatric inpatients is an increasing problem (Nijman, Allertz, Merckelbach, Campo, & Ravelli, 1997; Shah, 1993).

Most empirical work has, however, focused on long-term prediction of violence. Success has been modest (Monahan, 1988; Monahan & Steadman, 1994), although new instruments of risk prediction, or instruments assessing conditions strongly related to risk, show more promising results (Grann, Långström, Tengrström, & Kullgren, 1999; Hart, Cox, & Hare, 1995; Strand, Belfrage, Fransson, & Levander, 1999; Webster, Douglas, Eaves, & Hart, 1997).

Although some studies have examined the short-term prediction of assaultive behavior by psychiatric inpatients, the apparent increase in such behaviors suggests that useful predictive instruments and knowledge are lacking (Rasmussen & Levander, 1996b). Also, Bjorkly (1994) concluded that future research should focus on intensive prospective prediction studies.

Linaker and Busch-Iversen (1995), in their study at the Regional Secure Unit at Brøset, Norway, examined the daily reports of all patients admitted to the unit over a 5-year period. The six most frequently recorded changes in behavior during a 24-hour period prior to a violent incident were confusion, irritability, boisterousness, physical threats, verbal threats, and attacks on objects. These behavior changes were all shown to be predictive of violence, according to logistic regression analysis.

Sudden and unpredicted outbursts of violence among patients will obviously represent a substantial stress factor for staff. Better knowledge about the mechanisms underpinning violence and short-term predictive instruments allowing early interventions will help to reduce the level of stress. With these aids, valuable resources can be better used, and thus, staff and patients will be less exposed to violence. Current risk assessment instruments, such as the HCR-20 (Webster et al., 1997), are intended to predict far into the future and have mainly been validated in forensic populations; ratings are completed through interview, and a high commitment can be involved to complete this effectively. The Brøset Violence Checklist (BVC) takes about 5 minutes to fill in, whereas the HCR-20 can take several hours or, depending on the accessibility of medical records, even weeks to complete.

In psychiatric inpatient units, such a time commitment is unfeasible; therefore, there is a need for a quick and easy-to-use instrument to predict risk. Furthermore, if instruments are to be used to assist the decision-making process, they need to be empirically sound, reliable, and theoretically grounded; that is, based on research literature and possessing high face and content validity (Woods, Reed, & Robinson, 1999). The aim of the present study was to determine the clinical validity and reliability of the BVC, as well

as to examine the differences between the violent and not-violent individuals and to study the effectiveness of the variables in predicting violence.

METHOD

Participants

Participants were all patients admitted to four acute wards at four different psychiatric hospitals in central and southern Norway during a 2-month period in the spring of 1997. All four hospitals represented in the study admit patients from both rural and urban areas. The units had 7, 10, 11, and 10 beds, respectively. Nursing staff-to-patient ratios (total number of nursing staff divided by the total number of beds) were about 1.9, 2.1, 2.1, and 2.5, respectively. The average ratio for acute wards in Norway is 2.74 (Halsteinli, 1998). During the study period, 109 patients were admitted to the four sites, 52 men and 57 women. Two of the patients were younger than 20 years of age; 23 were between 20 and 30 years old; 36 were between 31 and 40 years old; 22 were between 41 and 50 years old; and 26 were older than 50 years. The majority of the patients were involuntarily admitted ($N = 65$; 59.6%) under the Norwegian Mental Health Act, sections 3 or 5. No information on diagnosis was collected; however, future research will include this as a key variable as this may have bearing on the results (Rasmussen & Levander, 1996b).

Instruments

Behavioral data during the study period were collected using the BVC, which was developed from the empirical work of Linaker and Busch-Iversen (1995). It measures six variables: confusion, irritability, boisterousness, physical threats, verbal threats, and attacks on objects. Each of the six items on the BVC is scored for its presence (1) or absence (0). For well-known patients, an increase in the behavior described above is scored as 1, whereas the habitual behavior while being nonviolent is scored as 0. The sum of scores is then totaled. The scoring is interpreted as follows: A sum of 0 suggests that the risk of violence is small; scores 1 and 2 suggest that the risk of violence is moderate, and preventive measures should be taken; and scores of 3 and more indicate that the risk of violence is very high, immediate preventive measures are required, and plans for handling an attack should be activated.

Violent incidents were recorded by use of the standardized incident-report forms in general use throughout the hospitals. These are based on the Staff

Observation Aggression Scale (SOAS) (Palmstierna & Wistedt, 1987). This is an observer-based instrument, which has been reported to typically record between 87% and 98% of those incidents that actually occur. This is opposed to a rating method based on charts and records alone, which typically documents between 27% to 53% of the incidents (Silver & Yudofsky, 1991). The SOAS has been a standard instrument widely used in Norwegian psychiatric hospitals for nearly a decade and is seen as an example of good practice for staff in-service training. However, the problem of underreporting probably exists and should be borne in mind when interpreting the data.

As a rule, all employees were required to complete an incident report form if they were subjected to any assaultive behavior by a patient or if a patient assaulted another patient or visitor. Assaultive behaviour was defined as physical activity in which a patient's behavior directed toward another was perceived to be potentially harmful. Thus, in addition to violent incidents in which there had been actual physical contact, incidents such as throwing objects were also included. Threats that were only verbal were not classified as violent incidents.

Procedure

Via meetings and workshops, all four participating wards were given information and instructions about the study, the methods employed, and the use of the BVC. Key staff, including ward managers, also participated in regular meetings during the study period to identify possible problems. No major problems were reported. The first author made frequent follow-ups to offer support, either personally or by telephone. All nursing staff members were involved in data collection, including nurse managers, psychiatric nurses, staff nurses, and nursing assistants. The BVC was completed about 2½ hours after the beginning of each nursing shift by the patient's primary nurse for the shift, allowing staff time to observe for the behaviors being rated. Thus, a prospective scoring procedure was adopted, as opposed to a retrospective one where an incident occurring on a shift easily could affect the BVC scores.

Before the present study, a pilot study was undertaken in a nonparticipating hospital to address the suitability of the instrument (Almvik, 1996). Four nurses were asked to complete the BVC and to report any reasons for errors or misunderstanding in the scoring procedure. None were reported. The study was approved by the Regional Ethics Committee for Medical Research in Trondheim.

RESULTS

BVC scores

During the study period, 12 of the 109 patients were reported to have been involved in an incident, 4 males and 8 females. These patients were involved in a total of 34 violent incidents. Although some researchers conclude that gender is not a strong predictor of involvement in violence by psychiatric patients (Newhill, Mulvey, & Lidz, 1995), Rasmussen and Levander (1996a) found in their study of a Norwegian forensic population that female patients were responsible for a disproportionate number of incidents, findings that also have been confirmed by other authors (Larkin, Murtagh, & Jones, 1988; Palmstierna & Wistedt, 1989). However, the small sample size in this study does not allow the authors to generalize or draw other conclusions on this subject.

BVC data were missing for one reported incident. Therefore, 33 violent incidents were analyzed. All incidents involved physical contact with the victim, who in all cases was a member of staff. Although attacks on other patients were included in the study, none occurred. Of the 33 incidents, 11 were reported to have no understandable reason or precursor; 8 incidents took place while the patient was being helped with activities of daily living; and 7 incidents happened when the staff was setting limits for the patients' behavior. Other situational characteristics included refusal of activities (3), during admittance (2), and refusal of medication (2); one patient was reported to act out motivated by anxiety. None of the incidents commenced during physical restraint or when the patient was being secluded.

Data were recoded to examine the hypothesis that a score of 2 or more is predictive of violence in the next 24-hour period ($n = 901$). This was achieved by matching each rating received with incidents that occurred on the shift of the rating and the following two shifts. For example, if a rating was done on the morning shift, the incident data were examined later on the same morning and during the afternoon and the evening shifts. Consequently, this left 64 ratings where there was a score of 2 or above and an incident occurred in the next 24 hours. In summary, the behavior of confusion showed in 50% of the ratings, irritability in 58%, boisterousness in 53%, verbal threats in 34%, physical threats in 23%, and attacks on objects in 33%. As for the 837 ratings below a score of 2 in which no violence occurred, confusion showed in 16% of the ratings, irritability in 7%, boisterousness in 5%, verbal threats in 2%, physical threats in less than 1%, and attacks on objects in just above 1%. Examining the significance of the differences in BVC scores between the violent

TABLE 1: Reported Chi-Square Results Between Violent and Not-Violent Patients

	Violent		*Not Violent*		
Behavior	*Yes*	*No*	*Yes*	*No*	χ^2
Confusion	32	32	134	703	43.47***
Irritability	37	27	61	776	151.40***
Boisterousness	34	30	45	792	163.54***
Verbal threats	22	42	16	821	147.17***
Physical threats	15	49	8	829	111.93***
Attacks on objects	21	43	9	828	176.32***

NOTE: *df* = 1; *** very highly significant (< 0.001)

and nonviolent groups by chi-square tests, all six behaviors were found to be significant beyond the 0.001 chance level (see Table 1).

Examining the distribution of scores between the two groups, the not-violent patients were found to have a mean of 0.32 (*SD* = 0.74, minimum = 0, maximum = 5), and the violent patients a mean of 2.5 (*SD* = 1.95, minimum = 0, maximum = 6). A significant difference was found between the means, indicating that the not-violent patients scored significantly lower on the BVC than did the violent patients ($t = -8.881$, $df = 64.394$, $p < 0.001$, 95% CI = –2.67 to –1.69).

Interrater Reliability

Two methods were used to examine interrater reliability on a set of ratings by two independent raters ($N = 39$). The Kappa values for the six BVC items were: confusion, $\kappa = 0.91$; irritability, $\kappa = 0.68$; boisterousness, $\kappa = 0.61$; verbal threats, $\kappa = 0.48$; physical threats, $\kappa = 0.66$; and attacks on objects, $\kappa = 1.00$. The Kappa value for the total BVC score was $\kappa = 0.44$.

The second method used was percentage exact rater agreement, which is a complementary method for categorical data. This method is particularly useful as a descriptive measure of data. For example, pairs of raters may be agreeing that attacks on objects is a characteristic not present in practically all patients. Although this is not a direct reflection of the reliability of the item, it allows one to ascertain that agreement on its absence is present. Findings were as follows: confusion, 97% agreement (1 pair of raters not agreeing); irritability, 90% agreement (4 pairs of raters not agreeing); boisterousness, 90% agreement (4 pair of raters not agreeing); verbal threats, 95% agreement (2 pairs of raters not agreeing); physical threats, 97% agreement (1 pair of raters not agreeing); and attacks on objects, 100% agreement.

TABLE 2: Sensitivity and Specificity at the Different Cutoff Scores for the Brøset Violence Checklist Summed Scores

Cutoff Score	*Sensitivity*	*Specificity*
1 and above	0.75	0.80
2 and above	0.63	0.92
3 and above	0.50	0.97
4 and above	0.39	0.99
5 and above	0.22	0.99
6	0.02	1.00

Prediction of Incidents

Sensitivity and Specificity. The sensitivity of an instrument (TP/[TP + FN]) reflects how often a prediction is correct; that is, our hypothesis that a score of 2 and above predicts a violent incident in the next 24-hour period. The specificity (TN/[TN + FP]) reflects how often a prediction of no violence with scores 0 and 1 is correct.

Table 2 displays all possible sensitivity and specificity results for the scores obtainable following a rating relative to an incident occurring in the next 24-hour period. It is apparent from the results that a score of 2 or more predicts a violent event in the next 24-hour period.

Receiver Operating Characteristics (ROC) Analyses. A further method of examining the potential utility of the BVC in differentiating between the nonviolent and violent is by means of ROC analyses (Rice & Harris, 1995). ROC analyses involve calculating 1-specificity and all possible cutoff scores on the test by plotting these values to form a curve, with the elevation and shape of the curve being of interest. The area under the ROC curve (AUC) represents elevation and reflects the BVC's efficiency across its entire range of scores. This is interpretable as the possibility that a randomly selected violent individual will have a higher score than a randomly selected nonviolent individual. An AUC of 0.5 is indicative of chance-level predictive accuracy, greater than 0.5 indicates above-chance accuracy, and less than 0.5, below-chance accuracy. In relation to the shape of the curve, a curve that has a prominent elbow reaching close to the top left corner represents a cutoff score that maximizes overall predictive efficiency (e.g., 1-specificity = 0 and sensitivity = 1). Curves that touch the chart's top or left side indicate useful screening cutoff scores. ROC analyses were performed using the nonparametric method in

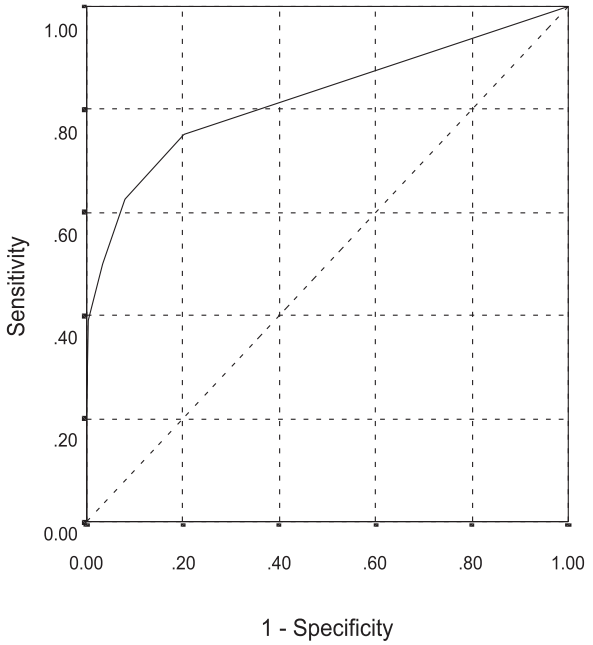

Figure 1: Receiver Operating Characteristic (ROC) Analysis of Brøset Violence Checklist Performance

SPSS for windows, Release 9.0. Figure 1 represents the ROC curve for the BVC. The AUC is 0.82 ($SE = 0.04$), with a 95% CI of 0.75 to 0.89. This represents a highly significant improvement over chance, $p < 0.001$.

However, it could be argued—and, indeed, it has been through personal communication—that recoding the data with the effect of allowing an incident to appear more than once in the dataset has the effect of increasing the sensitivity and specificity. Moreover, different periods in the 24-hour period will be more predictive than others. To examine this, data were examined by the time of day the rating was taken and incidents that occurred on that shift and the next two. Table 3 reports the sensitivity and specificity results and shows clearly that this effect did not occur. Also seen in this table is that the overall sensitivity for the night shift is lower than on both the day and afternoon shifts. This might be explained by the fact that, usually, fewer violent episodes take place during the night, as the patients are asleep, are medicated to sleep, or low night-shift staffing forces staff to practice other strategies than usual to avoid physical outbursts from the patients.

TABLE 3: Sensitivity and Specificity Results for Each Period (*N* = 901)

	Sensitivity	*Specificity*
Brøset Violence Checklist (BVC) day-shift rating		
Incident day shift	0.82	0.92
Incident next shift (afternoon)	0.73	0.91
Incident next shift (night)	0.71	0.90
BVC afternoon-shift rating		
Incident afternoon shift	0.67	0.90
Incident next shift (night)	0.63	0.89
Incident next shift (next day)	1.00	0.90
BVC night-shift rating		
Incident night shift	0.5	0.93
Incident next shift (next day)	0.67	0.93
Incident next shift (next afternoon)	0.67	0.93

DISCUSSION

The results indicate that the BVC is a useful instrument in predicting violence within the next 24-hour period and that the psychometric properties of the instrument are satisfactory. Many studies that have examined violence prediction report low interrater reliability for the associated prediction instruments (Bjorkly, Havik, & Loberg, 1996). Often, it can be seen that reliability data reported express an association between raters and not necessarily an accurate elucidation of agreement between ratings (Bartko & Carpenter, 1976). The methodology used in this study yields satisfying interrater reliability in both the methods described here. Kappa values range between +0.44 to +1 and, therefore, exceed values described in other studies, which typically report kappa values between +0.20 and +0.30 for interrater reliability (Menzies, Webster, & Sepejak, 1985).

The sensitivity and specificity results indicate that the BVC is discriminating the violent from the not-violent over the next 24-hour prediction period. More specifically, it is 63% accurate in predicting that violence will occur within the next 24 hours and 92% accurate in predicting that violence will not occur. The problem of false positives in particular, as well as false negatives, has been of constant concern for many researchers involved in violence-prediction research. What is an acceptable sensitivity and specificity level is a matter for ethical debate, which must take into account the consequences if a result is applied to clinical practice. For the BVC's purpose, it can be argued that selecting a cutoff score of 2 yields acceptable results in terms of sensitivity and specificity.

One of the problems inherent in violence-prediction research is the difficulty of ascertaining whether a violent act has actually occurred. One of the advantages of the BVC is that it relies solely on readily observed behaviors displayed by inpatients. Long-term prediction instruments often take into account demographic variables, as well as past behavior. For nursing staff who need to plan for the imminent future, such information is not always readily available. Indeed, in the acute ward setting where this study took place there is typically little or no information available about the patient at time of admission or for the next couple of days. It has also been suggested that clinical variables play a more important role in violence prediction in acute psychiatric patients than do demographic variables (McNiel, Binder, & Greenfield, 1988). Rasmussen and Levander (1996a) showed that patients who had been violent in other settings were not necessarily those who were violent within a hospital setting. Consequently, a quick and easy-to-use instrument requiring only observation of behavior in the ward should be useful for daily treatment-planning needs, supplementing the already existing clinical and actuarial assessments of risk.

The problem of low base rates of predicted behaviors has frequently been noted in violence-prediction research. The less frequently a predicted behavior occurs, the more correct a negative prediction will be. In the present study, 64 of the 901 observations were followed by a violent incident. If the task for the raters/observers had been to predict violence, one could have expected that chance ratings alone would have yielded a high specificity. However, the task in the present investigation was to rate observed behaviors, which was done with a relatively high interrater reliability. It also should be mentioned that the staff were not aware of the interpretations of the scores, a factor that might have reduced the chance that making the ratings influenced interaction with the patient.

It has previously been argued that the more strongly a predictor variable is related to the dependent variable, the stronger the prediction will be. Three of the BVC variables (verbal threats, physical threats, and attacks on objects) are conceptually more strongly related to the predicted behavior. However, the other three variables (confusion, irritability, and boisterousness) showed better predictive ability. It is of interest to note that irritability is the behavior with the highest correlation to violent incidents, a conclusion that was not made in the Linaker and Busch-Iversen (1995) study. This might be due to sample differences; in the Linaker and Busch-Iversen (1995) study, the sample was drawn from high-security/forensic patients. In another study, which used the Nurses' Observational Scale for Inpatient Evaluation (NOSIE), it was also found that irritability was a strong predictor of violence (Swett & Mills, 1997). Future studies should elucidate more accurately what lies

behind the behavior rated as irritability to better understand and thereby predict violent behavior.

In conclusion, the applicability of the BVC appears to be promising for the prediction of violence. However, more studies need to be undertaken to further examine its constructs, reliability, applicability, and validity. At present, validation studies are planned or already running in five different European countries, as well as Canada and Australia. Results from these studies will inter alia give us information on cultural differences, the validity of the BVC in less well-staffed wards, and the psychometric properties of the instrument. Also, a study in both acute and forensic wards will be carried out within the next year to examine the clinical use of the checklist and its ability to predict violence throughout the hospital stay or over a longer time period. A larger study to investigate whether reliability can be further improved by group rating is also suggested.

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