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ACUTE AGGRESSION RISK: AN EARLY WARNING SIGNS METHODOLOGY

1. Abstract

1.1. Purpose

Predicting the imminence of high risk behaviours in in-patients with schizophrenia is an ongoing concern. This study explores the utility, validity and reliability of an adapted early warning signs methodology for dynamic risk assessment.

1.2. Design

Nursing staff were interviewed to identify operationally defined early warning signs of high risk behaviours. Frequency of occurrence of the early warning signs and the high risk behaviour were rated over a one week period to establish the predictive validity of the methodology.

1.3. Findings

Support was found for the reliability of staff ratings of the relevance of identified early warning signs and their occurrence within a specified time period. ROC analysis indicates some modest predictive validity in predicting aggressive risk behaviours but effect sizes were small, and there were high rates of false positive predictions.

1.4. Value

A dynamic risk assessment methodology to assess changes in risk for inpatients would benefit both staff and inpatients. No such methodology has been assessed to date.

1.5. Research Limitations

The small sample size limits generalisability. A longitudinal prospective study to better establish the added predictive power of the method over the use of largely actuarial methods is needed.

2. Introduction

A diagnosis of schizophrenia is associated with an increased risk of aggressive and violent acts compared to the general population (Mullen, 2006). This finding applies to both community (Bonta *et al.*, 1998) and inpatient settings (Larkin, *et al.*, 1988). Indeed, rates of inpatient aggression have been estimated to be around 10-45% with a median rate of 25% (Monahan, 1992; Daffern *et al.*, 2007). Admission itself can often precipitate an increased risk of aggression, with one in four aggressive incidents (and a third of physical attacks) occurring in the first three days of admission (Abderhalden *et al.*, 2007). Similarly, people with a diagnosis of schizophrenia are at increased risk of suicide with a rate of 4-6.8% (Pompili *et al.*, 2005) or around eight times that of the general population. Even higher rates (20-40%) are present for attempted suicide (Drake, cited in Pompili *et al.*, 2005). Notably, a minority of inpatients are responsible for a large proportion of violent incidents (Blumenthal and Lavender, 2000; Aberhalden *et al.*, 2007). Andrews *et al.*'s (1990) principles of 'risk, need and responsivity' are of particular relevance here: they propose that increased resources should be allocated to service users at highest risk; their treatment should focus on specific risk factors and should be tailored to the individual. Suicide risk is increased shortly after admission to hospital and shortly following discharge (Pompili *et al.*, 2005), with a substantial proportion of suicides by people with schizophrenia committed whilst on leave from hospital or during absconscion (Shah and Ganesvaran, 1999).

The current consensus in risk assessment and management recommends the adoption of a structured clinical judgement approach, that draws upon empirical factors identified from the scientific literature, combined with the judgement of experienced clinicians, and their knowledge of the individual patient (Department of Health, 2007; National Institute for Clinical Excellence, 2005). Actuarial risk assessment tools support this approach, and have been shown to have validity in predicting future recidivism, over a longer time period, usually years (Craig *et al.*, 2008). They have, however, been criticised for being heavily reliant on so called 'static' risk factors and therefore insensitive to factors which indicate a change in risk state over time (Otto, 2000). They are less helpful for short-term risk prediction (acute risk) or for informing risk prevention and management on an ongoing basis (Daffern, 2007). So-called acute dynamic risk factors (Douglas and Skeem, 2005) are useful in guiding the level of supervision or monitoring required in managing and preventing imminent risk (Boer *et al.*, 2007; Craig *et al*., 2008).

A number of authors have considered and developed measures relating to dynamic risk, including acute risk factors (Daffern, 2007). However whilst these measures include dynamic indicators of risk and utilise behavioural observations, they do not allow for the incorporation of idiosyncratic factors, relying on those that have been shown to have the highest predictive validity for aggression (an inter-individual comparison). Risk assessment should involve a consideration of how empirical, static and dynamic risk factors manifest in an idiosyncratic way in an individual patient: two patients both experiencing command hallucinations may act aggressively one in response to perceived commands the other due to the effects of substance use to manage distress associated with their voices. A methodology to assess acute risk in light of the patient's own presentation is thus essential in guiding treatment and management efforts. Such acute signs would need to be clearly, individually and operationally defined. Such a methodology is lacking at present and awaits systematic evaluation of its reliability and validity.

One approach that potentially offers a framework for the assessment of acute risk is that used for predicting relapse in individuals with schizophrenia (Birchwood *et al.,* 1989) and is now part of routine care (Burns, 2004; National Institute for Clinical Excellence, 2009). These idiosyncratic 'early warning signs' of relapse are derived from checklists and interview methods and identify relevant signs and the order in which they occur. These are subsequently used by the individual, staff and carers to develop an action plan to prevent relapse and hospital admission. An idiosyncratic "relapse signature" is monitored by the individual, staff and carers and the action plan put into place once early signs are detected. Whilst discussed anecdotally in the risk literature (Collins and Munroe, 2004), this approach has not been systematically applied to the prediction of risk behaviours.

Understanding, and being able to predict, the imminence of acts of aggression to self and others in inpatient settings is of particular importance. Perhaps surprisingly, risk assessment is not universally accepted as a core nursing role (Standing Nursing and Midwifery Advisory Committee, 1999) even though inpatient nursing staff are the professional group who have most day to day contact with inpatients (Whittington, 1994) and may arguably be best placed to assess and identify idiosyncratic signs of changing risk status (Boer, *et al.*, 2004). Moreover nursing staff are as able as other disciplines to predict aggression (Haim *et al.*, 2002), and themselves are at the highest risk of assault, (Whittington, 1994).

The present study employs an adapted an early warning signs of psychosis methodology to identify early warning signs of risk of aggression, defined as "the intention to hurt or gain advantage over other people, without necessarily involving physical injury" (Hollin and Howells, 2000). This term includes risk of aggression to self, others and property (as delineated in the Retrospective Overt Aggression Scale or ROAS; Yufofsky *et al.*, 1986). The detection of early warning signs of risk are particularly pertinent to high risk behaviours since the goal of intervention is to prevent their occurrence, as unlike lower risk behaviours where the use of contingency management may be used to alter its consequences, such high risk behaviours cannot be ignored.

3. Study Aims

Our main aim was to provide a clinically reliable method for nursing and other clinical staff to enable them to more accurately predict high risk behaviours providing the potential for early and timely intervention to diffuse aggressive incidents. In doing so we also aimed to test a procedure to reliably identify the presence of relevant idiosyncratic early signs and operationalise them to construct an early warning signs signature for a specified high risk behaviour. Finally we aimed to assess the predictive validity of this signature in predicting the occurrence of specified high risk behaviour in a given individual.

4. Method

4.1. Setting

The research was conducted in three High Dependency Units (as defined by Wolfson *et al.*, 2009) within the West Midlands. These units cater for inpatients requiring detention in a low secure environment, who are frequently detained under the Mental Health Act (2007; formerly 1983) and continue to present with high levels of risk and difficult to manage behaviours. The study was approved by South Birmingham Research Ethics Committee, Coventry University Ethics Committee and Birmingham and Solihull Mental Health Trust Research and Innovation Unit.

4.2. Participants

Interviews were conducted with nursing staff on 24 inpatients with high risk behaviours (18 male and 6 female, average age 47 [range = 40 to 69]). All had been inpatients for at least

6 months (average 106 months, range = 41 to 149) and had a formal diagnosis of schizophrenia (ICD-10: World Health Organisation, 2005), with 76% being formally detained under the Mental Health Act (1983).

The participating staff (N= 25; 12 female; 13 male) were separately grouped with one group classed as 'Interviewees' (N = 19- nursing staff) identifying potential early warning signs for one identified high risk behaviour using the Early Warning Signs of Risk Checklist (Meaden and Hacker, 2010) for each of the 24 inpatients, (with no Interviewees acting as a Raters).

Staff classed as 'Raters' (3 nursing and 3 clinical staff, a ward manager, a psychiatrist and an occupational therapist) were recruited to rate the frequency and relevancy of the identified early warning signs of risk (one member of nursing staff and one clinician per ward). Raters were also asked to rate the frequency of the specified high risk behaviour. All participants had known the patient concerned for at least 6 months, and were either the named nurse for them or a clinician or nurse who was regularly involved in their care.

5. Procedure

Named nurses consented to complete interviews to identify early warning signs of risk for their inpatients, using the Early Warning Signs of Risk Checklist (EWS-RC; Meaden and Hacker, 2010) as a prompt and a recording tool. The relevant early warning signs of risk were then operationally defined, by the named nurse under the guidance of KS, to form an idiosyncratic early warning signs signature. The interviewee then rated the relevancy of signs for their patient (see later for description of relevancy ratings) and the ten most relevant early warning signs of risk were then recorded to allow ratings of inter-rater reliability (the Relevance and Frequency Rating Sheet). Finally, five checklist items were utilised to form dummy variables (relevant in general to people with schizophrenia) for each inpatient. These were included to reduce demand characteristics which could artificially inflate agreement.

The principal researcher (KS) completed the Retrospective Overt Aggression Scale (Yudofsky *et al.,* 1986) for each patient from the case notes for a specified seven-day period. The nurse rater and clinical rater from each HDU were asked to independently rate retrospectively over

the same time period (using the relevancy and frequency rating sheet) each operationally defined early warning sign of risk for relevancy to the identified high risk behaviour and frequency of occurrence (see below) and the frequency of the specified high risk behaviour itself over the same period. These rating were informed by case notes and records of nursing observations (raters being required to have worked a normal shift pattern during the specified week).

6. Measures

6.1. Early Warning Signs of Risk Checklist (EWS-RC) (Meaden and Hacker, 2010)

The EWS-RC comprises three types of early warning signs of risk categorised conceptually as: changes in the person's behaviour which could be observed externally by others (e.g. agitation manifested as increased pacing) and termed 'visual signs'; changes in the person's verbalisations elicited through verbal interaction with the patient (e.g. specific comments about delusional ideas), termed 'verbal signs'; contextual factors acting as interpersonal or environmental triggers (e.g. a noisy ward or visits from relatives), termed 'contextual signs'. The checklist served as a useful starting point for facilitating discussion of relevant signs which were then operationally defined into an idiosyncratic early warning signs of risk signature by KS for the patient concerned in line with functional analytic principles (O'Neill *et al.*, 1997).

6.2. Relevancy and Frequency Rating Sheet (RFRS)

This measure utilises a five-point likert scale devised to rate the relevancy of each early warning sign of risk to the high risk behaviour, its frequency of occurrence (over a one week period) and the frequency and occurrence of the high risk behaviour over the same week. Anchor points adopted for relevancy ratings were; 1) not at all relevant, 2) slightly relevant, 3) somewhat relevant, 4) quite relevant and 5) very relevant. Anchor points adopted for frequency ratings of the both early warning signs of risk and the high risk behaviour were; 1) not at all, 2) 1-2 times, 3) on at least 3 occasions, 4) daily or almost daily, and 5) several times a day, almost every day.

6.3. Retrospective Overt Aggression Scale (ROAS)

The ROAS, based on the Overt Aggression Scale (OAS) (Yudofsky *et al.*, 1986), was primarily developed to measure aggression in adult inpatients in psychiatric centres. It has an intra-class correlation coefficient for physical aggression of 0.72 to 1.00 (Yudofsky *et al.*, 1986), and has previously been used to rate aggression using clinical notes (Malone *et al.*, 2000). The ROAS

domains used in this study were verbal aggression, physical aggression to objects, physical aggression to others, and physical aggression to self. Differing levels of aggression within these domains are rated by severity and frequency of behaviour to give an overall rating of severity of aggressive behaviours, and a rating for each domain. The ROAS has been shown to correlate significantly with the total frequency of the OAS, the Nurses Observation Scale for Inpatient Evaluation (Honigfeld and Klett, 1976) irritability factor and the Brief Psychiatric Rating Scale (Overall and Gorham, 1976) hostility factor, indicating validity as a measure for aggressiveness (Sorgi *et al.*, 1991). It has good internal consistency for the rating of aggression (0.75) and excellent inter-rater reliability (0.96). In the two studies reported by Sorgi *et al.* (1991), the ROAS was utilised by staff on a weekly basis. For the purpose of this study, the ROAS was used to rate overall aggression during a one week period, utilising case notes and violent incident reports forms.

7. Hypotheses

Based on the above aims 6 hypotheses were made:

1. There will be high levels of agreement on the dichotimised ratings of relevancy of early warning signs (dichotomised into 0 for 'not at all relevant', 'slightly relevant' and 'somewhat relevant' and 1 for 'quite relevant' and 'very relevant') when comparing the judgment of the initial Interviewee (nursing staff) with the Raters (nursing staff and clinical staff);
2. There will be a significant difference in the relevancy ratings between dummy and true early warning signs as rated by both Raters (nursing staff and clinical staff);
3. There will be a high level of agreement between Raters (nursing staff and clinical staff) with respect to whether the early warning signs for an individual client have been present or absent in the past week (dichotomised into 0 for 'not at all' and 1 for '1-2 times during the week' up to 'to several times a day almost every day');
4. There will be high levels of agreement between the Raters (nursing staff and clinical staff) on the dichotimised ratings of frequency with respect to whether the predefined high risk behaviour for an individual client had occurred in the past week (dichotomised into 0 for 'not at all' and 1 for '1-2 times during the week' up to 'to several times a day almost every day');
5. The ratings given by the Rater (nursing staff) will show high levels of agreement between the individual behaviour ratings and the ratings of aggression on the completed ROAS;

6. A higher frequency of early warning signs of risk will be associated with the occurrence of the specific high risk behaviour as identified by increased scores on the idiosyncratic behaviour rating measure.

8. Analysis

The distribution of data was analysed using the Kolmogorov-Smirnov test of normality. Non-parametric correlations were performed using Kendall's Tau and Kappa. T-tests were used to control for agreement by chance. Statistical analysis was carried out using SPSS for Windows version 16.0 and an online ROC analysis calculator (Eng, 2006).

9. Results

The individual high risk behaviours identified by the Interviewee (nursing staff) were summarised using operationally defined examples and ROAS behaviour descriptions (see Table 1 below).

INSERT TABLE 1 ABOUT HERE

Prompts used to identify the most relevant early warning signs of risk) taken from the EWS-RC) were tabulated, to examine whether particular prompts would be utilised more than others. 16 of the observable behavioural prompts, 3 observable verbal prompts and 1 contextual prompt were identified as relevant for more than 4 inpatients. The "other" category gave 32 further early warning signs of risk. Ten of these were listed by staff as the individual "shouting or talking loudly" and a further ten were described by staff as the individual "ignoring staff or losing engagement with them" (see Table 2 below).

INSERT TABLE 2 ABOUT HERE

9.1. Agreement on relevance of early warning signs of risk

The early warning signs of risk identified as relevant by the Interviewee (nursing staff) were dichotomised into 0 for identified early warning signs of risk and 1 for dummy early warning signs of risk. Cohen's kappa was used as a measure of agreement between these dichotomised signs of risk and the dichotomised ratings of relevance given by the Raters

(nursing and clinical) and showed a 'fair' level of agreement (Nurse rater: K = 0.292; p < .01; Clinical rater: K = 0.251; p < .01), as defined by Landis and Koch (1977).

A paired sample t-test (two-tailed) revealed a significant difference between the perceived relevancy of the identified early warning signs of risk versus the dummy early warning signs of risk (nurse rater: identified: M = 33.33, SD = 7.01 versus dummy: M = 11.75, SD = 4.40; t (23) = 19.279; p<.01; clinical rater: identified: M = 32.29, SD = 7.01 versus dummy: M = 11.33, SD = 4.28; t (23) = 21.784; p<.01).

This suggests that staff could reliably distinguish between dummy variables and early warning signs of risk relevant to the individual patient.

9.2. Agreement on the occurrence of early warning signs of risk

Agreement on the presence or absence of an early warning sign over a specified time period was tested using crosstabulation. A moderate level of agreement regarding presence or absence of the early warning signs in a set 7-day period, as rated using the RFRS, was found between the Raters (nursing and clinical) (K = 0.421, p = < .01). This suggests that nursing and clinical staff can reliably identify and rate the presence or absence of early warning signs of risk behaviour when they are operationally defined.

9.3. Agreement on the occurrence of the specified high risk behaviour

Cohen's kappa was used as a measure of agreement between the dichotomised frequency scores for the occurrence of the specified high risk behaviour and showed a 'fair' kappa value (K = 0.364; p = .074), as determined by Landis and Koch (1977). The internal validity of the idiosyncratic behaviour rating was assessed by correlating the ROAS Total score with the frequency rating of the idiosyncratic behaviour and the two measures showed a significant correlation (T = 0.365, p=0.022).

This suggests that nursing and other clinical staff can reliably rate the presence or absence of high risk behaviours when they are operationally defined, and that the idiosyncratic behaviour rating has some validity in relation to the ROAS in rating the frequency of occurrence of specified high risk behaviours.

9.4. Early warning signs as predictors of high risk behaviours

A ROC analysis was undertaken to examine the overall predictive accuracy of the early warning signs of risk (based on the total frequency ratings for the relevant early warning signs) in predicting idiosyncratic behaviour rating scores (dichotomised into 0 for 'not at all' and 1 for '1-2 times during the week' up to 'to several times a day almost every day'). Of the total 24 cases, 9 were positive (coded as '1') and 15 were negative (coded as '0') with respect to the occurrence of the risk behaviour. The fitted AUC was 0.604 (estimated std. error = 0.1174). Therefore the predictive accuracy is above chance (AUC = 0.5) but the overall predictive accuracy represents a small effect size (Kraemer, *et al.*, 2003).

In all 24 cases there was no single occurrence of the risk behaviour in the absence of at least 3 early warning signs of risk (irrespective of the frequency of occurrence of signs). Conversely, as many as 9 early warning signs occurred without the occurrence of a risk behaviour following. In Table 3 values for sensitivity, specificity and predictive power are provided using two cut offs for clinical illustration: a cut off of the occurrence of 3 or more early warning signs of risk to classify patients as at risk for the behaviour and a more conservative cut-off of 6 or more signs (few early warning signs of risk ratings occurred for 4 or 5 signs). Low specificity means that a large number of clients who were not 'at risk' would be falsely classified as such. Positive predictive Power (PPP) refers to the confidence that can be attributed to an individual positive result (i.e. the presence of risk), whilst Negative Predictive Power (NPP) relates to the confidence that can be attributed to a negative result (the absence of risk). As illustrated, a cut-off of 3 or more early warning signs provides maximal sensitivity and NPP but, conversely, the specificity is poor and the PPP low (40%). Using a more conservative cut-off of 6 or more early warning signs does not improve PPP and actually lowers NPP from 100% to 62.5%. This indicates that the methodology provides a high number of false positive classifications of individuals as 'at risk'.

INSERT TABLE 3 ABOUT HERE

10. Discussion

Previous research indicates that environmental factors (Johnson *et al.*, 1997), individual characteristics of the patient (Daffern et al, 2007) and symptomatology (Hacker *et al.*, 2008) are all potential triggers of early warning signs of high risk behaviours. In applying this to the individual

patient, for monitoring of acute risk by multidisciplinary staff, it is essential that both behaviours and early warning signs of risk are operationally defined in an idiosyncratic way.

As might be anticipated, in the present study, there were some general early warning signs of risk (present as general prompts for categories on the initial checklist) that were endorsed more frequently than others by staff: "increases in demands; swearing, social withdrawal, staring and pacing; medication non-compliance." Research has found that ward staff tend to overestimate the significance of medication non-compliance (rated at joint sixth in this study) and focus on clinical conditions rather than social or environmental factors (Mulvey and Lidz, 1998); those we have termed contextual factors. In fact environmental factors are hugely important determinants of behaviour in inpatient settings (Daffern, 2007). Research carried out in accident and emergency departments has shown that pacing and staring were two of the top five observable behaviours reported by staff (Luck *et al.*, 2007) as relevant to aggressive behaviours. Results from the present study support these findings. An advantage of using an initial checklist covering broad areas of early warning signs of risk is that it ensures that a range of such signs and triggers are considered before they are then operationally defined and made idiosyncratic to the patient.

The present results are encouraging and indicate that the early warning signs of risk methodology described here holds promise as one potential strategy for addressing the detection of acute risk and hence prevention of actual aggression. Provided that early warning signs of risk are clearly and operationally defined using a structured protocol inpatient staff appear able to achieve a 'fair' degree of agreement regarding the relevance of signs to a particular patient and a 'moderate' degree of agreement on their presence over a seven day period. This suggests that the presence or absence of pre-defined early warning signs of risk can be reliably rated and recorded by staff. Staff were also able to reliably rate the frequency of occurrence of an operationally defined risk behaviour and these ratings showed a positive association to the better validated, but more general measure of behaviour, the ROAS. This suggests that the idiosyncratic rating of behaviour has some validity as a measure of aggressive behaviour and that inpatient staff are able to reliably rate when these behaviours are present and how often they occur when cross-referencing with clinical notes, staff handovers, and records of direct observation.

Early warning signs were found to be retrospectively predictive of the occurrence of high risk behaviours but only with a small effect size based on Area Under the Curve analysis (AUC =

0.6). Whilst small this effect is above chance levels of prediction. Examination of the sensitivity, specificity and predictive power suggests that the methodology is prone to generating false positive predictions of 'at risk' status and levels of PPP of about 40%. This is, however, not unique to the current methodology but is an issue with risk prediction in general: even with tools with relatively high values of sensitivity and specificity, PPP will be low since the base rate of the occurrence of risk behaviours is itself somewhat low (Conroy and Murrie, 2007). Indeed high risk behaviours have a low base rate of occurrence in inpatient populations (Klassen and O'Connor, 1988) and in the present study only 9/24 participants displayed aggressive behaviour in the specified time period.

In addition, there may be a number of factors in the present study which attenuated the relationship between early warning signs and risk: the small sample size in general, limits possible discrimination between groups. Furthermore, the relationship between early warning signs and the occurrence of risk behaviours is not necessarily symmetrical: in the 24 cases studied there was no single occurrence of the risk behaviour in the absence of at least 3 early warning signs of risk. Conversely, as many as 9 early warning signs of risk occurred without the occurrence of a risk behaviour following. Clearly not every occurrence of early warning signs of risk led to the occurrence of the specified risk behaviour and this may, in no small part, be influenced by the coping strategies of the patient or active early intervention by staff. In this respect it would be useful, in future studies, to include a measure of aggressive ideation rated by the patient in question at times when early warning signs of risk have been present and at times when they have not. The present study was further disadvantaged by the fact that different staff rated different inpatients which may potentially reduce the significance of the findings; this is however, most likely to be the clinical reality of routine practice situations in such units.

10.1. Implications for future research

Future studies may consider employing a prospective longitudinal approach to test the prediction of high risk behaviours at multiple time points, in line with recommendations for the measurement of dynamic risk (Douglas and Skeem, 2005). Furthermore, a retrospective, post-mortem, based upon interviews with staff immediately following an occurrence of a high risk behaviour, would arguably allow more accurate information regarding early warning signs of risk to be obtained and signs revised accordingly (in line with best practice principles in developing early warning signs of psychotic relapse; Birchwood et al., 2000). It would also be useful to

evaluate the current methodology in terms of the degree to which it provides added predictive value above and beyond more generic rating scales of dynamic risk and more actuarial based measures of risk prediction. The present study did not have sufficient numbers of participants to test the predictive validity of early, middle and late stage signs in the escalation of risk. This would be an important focus in future studies.

11. Conclusions

The adoption of a structured early warning signs of risk methodology shows promise in the monitoring of acute risk, providing staff with a reliable procedure for identifying and addressing potential signs of risk thus reducing inpatient aggression. Cognitive, behavioural and other psychosocial interventions could be offered in the presence of these signs to prevent escalation of an acute risk state into the occurrence of a high risk behaviour (Meaden and Hacker, 2010).

Caution is however required as the methodology does generate a high number of false positive predictions, (in common with other risk assessment methods). The degree to which the current method adds incrementally to the predictive accuracy of these methods for short-term assessments of risk remains to be established.

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Table 1

Types of High Risk Behaviours Identified from the ROAS, EWS-RF and RFRS and their Rater

Behaviour Type as rated by the ROAS	Example of Behaviour taken from EWS-RF and RFRS	Behaviours Identified by Interviewed Nurse by Number of Inpatients	Behaviours Rated as Present
Physical Aggression Against Others			
Strikes, kicks, pushes, pulls hair (includes throwing objects at others)	Clenched fist, thumping others on the head or in the kidneys.	16	5
Makes threatening gestures, swings at people, grabs at clothes	Incoherent shouting, shaking fists at staff.	6	4
Physical Aggression Against Objects			
Sets fires	Will become obsessed with setting fires, and will attempt to set one. Will set off the fire alarms if unable to set a fire.	1	0
Physical Aggression Against Self			
Swallowing objects to self-harm	Swallowing objects secretively e.g. batteries and coins.	1	0
	TOTAL	**24**	**9**

Table 2

Most Common Types of Early Warning Signs of Risk

Identified Individual Early Warning Signs of Risk	**Number of Inpatients**
Contextual	
Contact with family	4
Verbal	
Erratic speech	7
Increased pre-occupation with delusions	7
Increased conviction in delusions	5
Increased complaints about inpatients	4
Behavioural	
Increase in demands	14
Increased bad language/swearing	13
Social withdrawal	13
Staring	12
Pacing	11
Refusal to take medication	9
Vocalising out loud	9
Increased smoking	8
Invading personal space	8
Decrease in personal hygiene	6
Erratic sleep patterns	6
Refusal to eat	6
Increase in insults/threats	5
Quiet	5
Loss of engagement in activities	4
Refusal to take advice	4
Other	
Shouting or talking loudly	10
Ignoring staff or losing engagement with them	10

Table 3

The Prediction of high risk behaviour using early warning signs

Cut-off Level (Total number of early warning signs rated as present)	True Positive	True Negative	False Positive	False Negative	Sensitivity	Specificity	Positive Predictive Power	Negative Predictive Power
3 or less early warning signs	9	2	13	0	1	0.13	40%	100%
6 or less early warning signs	6	5	10	3	0.66	0.33	37.5%	62.5%