IDENTIFYING KEY FACTORS ASSOCIATED WITH AGGRESSION ON ACUTE IN-PATIENT PSYCHIATRIC WARDS

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ABSTRACT

Aggressive behaviour is a critical issue for modern acute psychiatric services, not just because of the adverse impact it has on patients and staff, but also because it puts a financial strain on service providers. The aim of this study was to assess the relationship of patient violence to other variables: patient characteristics, features of the service and physical environment, patient routines, staff factors, the use of containment methods and other patient behaviours. A multivariate cross sectional design was utilised. Data were collected for a six month period on 136 acute psychiatric wards in 26 NHS Trusts in England. Multilevel modelling was conducted to ascertain those factors most strongly associated with verbal aggression, aggression towards objects and physical aggression against others. High levels of aggression were associated with a high proportion of patients formally detained under mental health legislation, high patient turnover, alcohol use by patients, ward doors being locked, and higher staffing numbers (especially qualified nurses). The findings suggest that the imposition of restrictions on patients exacerbates the problem of violence, and that alcohol management strategies may be a productive intervention. Insufficient evidence is available to draw conclusions about the nature of the link between staffing numbers and violence.

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INTRODUCTION

Violent behaviour by psychiatric inpatients has been an issue of concern and research for some time, and patient and staff safety is a critical issue for modern acute psychiatric services. In the UK the Ward Watch survey by mental health charity Mind reported that 27% of respondents rarely felt safe in hospital and half of recent or current inpatients reported being verbally or physically threatened during their stay (Mind 2004). The Royal College of Psychiatrists' National Audit of Violence found that a third of inpatients had experienced violent or threatening behaviour while in care. This figure rose to 41% for clinical staff and nearly 80% of nursing staff working in these units (Healthcare Commission 2005). Disruptive, aggressive and self-harming behaviours place enormous financial burdens on the UK's National Health Service. Mean annual costs (for staff time only) for all conflict behaviours across England's in-patient psychiatric wards exceed £72 million (US $141 million) per annum, whilst efforts to contain and prevent them cost an estimated £106 million (US $208 million) per annum (Bowers et al. 2007c). Adverse events can also cause significant distress for staff (and sometimes injuries) and are thought to contribute to low morale, high sickness, high staff turnover and high vacancy rates (Garcia et al. 2005;Needham et al. 2005b). Poor staffing levels result in more adverse incidents (Bowers et al. 2005a) and the consequent reliance on temporary staff is expensive and linked with lower standards of care (Audit Commission 2001).

Research to date has concentrated on the circumstances and frequency of aggressive behaviours (Grassi et al. 2001); patient factors such as diagnosis and symptomatology (Benjaminsen et al. 1996;McNiel & Binder 1994); risk assessment and prediction (Daffern & Howells 2002); effects on staff (Hunter & Carmel 1992;Needham, Abderbalden, Halfens, Fischer, & Dassen 2005b); and staff training (Needham et al. 2005a). In the UK, there has been a considerable investment in the training of mental health nurses and their unqualified assistants in de-escalation and manual restraint, although the efficacy of that training is uncertain (Bowers et al. 2005c). In the US there has been a greater emphasis on reducing the use of seclusion and mechanical restraint (Belanger 2001).

In the UK, acute inpatient psychiatric care is provided by the state funded National Health Service. Care is organised and operated by Mental Health Trusts which cover local populations, usually of about one million people. Wards are primarily staffed by a mix of qualified nurses and unqualified healthcare assistants. Only a minority of wards are equipped with seclusion rooms, and usage rates are very low. Mechanical restraint is not used. Up till the 1980s most of these wards were open, but today many inpatient wards are permanently locked, although this is contrary to official guidelines (Bowers et al. 2002;Garcia, Kennett, Quraishi, & Durcan 2005). The majority of such wards have access to a supporting Psychiatric Intensive Care Unit which has small numbers of beds, high staffing levels, and is generally locked (Bowers et al. 2007a).

For some years we have been conducting a programme of research into conflict and containment. Conflict between patients and staff broadly means violence, verbal

abuse, rule breaking, use of alcohol or illegal drugs, self-harm, medication refusal, and absconding by patients. Containment refers to methods used by professionals to manage or prevent such behaviours, e.g. seclusion, special observation, detention in hospital, searching procedures, restrictions on inpatients, intensive care, manual restraint, and enforced medication. Our aim is to understand the relationship between these events, with a view to reducing both to minimum levels. This paper reports new findings on variables associated with verbal aggression, aggression towards objects, and physical aggression towards others.

AIM

To assess the relationship of patient aggression to other conflict behaviours, the use of containment methods, service environment, physical environment, patient routines, staff demographics, and staff group variables.

METHOD

Design

A multivariate cross sectional design was utilised.

Sample

The sample comprised 136 acute psychiatric wards with their patients and staff in 67 hospitals within 26 NHS Trusts (organisational units with common clinical policies and investment levels) in England, proximate to three regional centres, in 2004-05. Acute psychiatric wards were defined as those that primarily serve acutely mentally disordered adults, taking admissions in the main directly from the community, and not offering long-term care or accommodation. Wards that were organised on a speciality basis, or that planned to change population served, location, function, or which were scheduled for refurbishment during the course of the study were excluded. Each centre identified all eligible wards within reasonable travelling distance of their research base. It was initially intended to randomly sample wards, with replacement for refusals to participate. However the geographical dispersion of wards outside of London meant that to achieve the requisite sample size, two centres had to recruit all available wards within practical reach for data collection. In London, it was possible to randomly sample from a list of 112 wards. The 136 acute psychiatric wards that participated in the study represented 25% of the estimated total of 551 wards in England. The study was approved by the NW Multi-centre Research Ethics Committee.

Instruments

The Patient-staff Conflict Checklist (PCC-SR), an end of shift report by nurses on the frequency of conflict and containment events (Bowers et al. 2005d) was collected for a six month period on all participating wards. The items for aggression were drawn with their definitions from the Overt Aggression Scale (Yudofsky et al. 1986), a widely used and validated instrument. Verbal aggression was defined as “Loud

noises, angry shouting, personal insults, cursing, foul language, threats, of a sufficient duration, intensity or volume that you would usually mention it in the nursing notes of the patient"; aggression towards objects was defined as "Slamming doors, making a mess, throwing things, kicking things, breaking things, setting fires"; and physical aggression to others as "Swings at people, grabs them, strikes, kicks, pushes, pulls hair, attacks others." For all incidents of self-harm or attempted suicide, a Bongar Lethality Scale (Bongar 1991) was completed as part of the PCC-SR, to assess the severity of the incident. This form was also used to collect a limited amount of data on patients (age, gender, ethnicity, diagnosis, reason for admission, and postcode). Postcodes were matched with local area deprivation data to yield deprivation scores (Index of Multiple Deprivation, IMD) for each hospital ward (Noble et al. 2004). Additional instruments used included the Attitudes to Containment Measures Questionnaire (ACMQ), used in three countries and found to be related to traditional usage patterns (Bowers et al. 2004;Bowers et al. 2007b); the Attitude to Personality Disorder Questionnaire (APDQ), found to be related to job performance, stress, burnout, sensitive to change over time and with good test-retest reliability (Bowers et al. 2005b;Bowers et al. 2006;Bowers & Allan 2006); the Ward Atmosphere Scale (WAS) utilised and related to outcomes in many studies and displaying good reliability (Moos 1974;Moos 1997); the Team Climate Inventory (TCI) validated with 121 teams from oil companies, psychiatric services, primary healthcare and social services (Anderson & West 1999); the Multifactor Leadership Questionnaire (MLQ) is underpinned by the theory of transactional and transformational leadership and has demonstrated good reliability and vaidity (Bass & Avolio 1995); the Maslach Burnout Inventory (MBI) utilised in many studies and is related to a range of outcomes including intention to quit (Maslach & Jackson 1981). The scales have been widely

used and have well established validity and reliability. They were distributed to subjects by the researchers and returned anonymously via a research 'post box' provided to each ward. Basic ward data was collected by a researcher visiting the ward and in conjunction with the ward manager, allowing the calculation of indices of ward observability (greater observability being indicated by fewer rooms, a lower number of vantage points necessary to observe the whole ward, and fewer exits), physical environment quality, and a variety of ward security practices including the intensity of patient searching (clothing and property), and the numbers of restrictions on inpatients (freedom of access to kitchens, bathrooms, water for hot drinks, etc.).

Data Analysis

Multilevel random effects modelling was carried out using MLwiN 2.02 statistical software, with verbal aggression, physical aggression against objects and physical aggression against others as the dependent variables, utilising poisson regression, with number of beds on each ward as the exposure or offset variable. Three level models were explored with shifts at the lowest level (1), wards at level 2 and Trusts at level 3, that is shifts were nested within wards, which were nested within Trusts. Shifts were chosen as a level because of clustering effects within AM, PM and Night shifts; wards for similar reasons, and Trusts because they represent organisational units with single local policies and operational procedures. The penalised quasilikelihood method of estimation (PQL) was used with second order linearisation, since this method does not tend to underestimate variance (Ukoumunne et al. 2007). The models were produced through a staged process of backward selection, deselecting the least significant at each stage. Each group of variables (domain) was used to build a separate initial

model, then the significant variables were used to construct a final comprehensive model using the same process of backward selection. Lists of all modelled variables and frequencies can be found elsewhere (Bowers, Whittington, Nolan, Parkin, Curtis, Bhui, Hackney, Allan, Simpson, & Flood 2007c). In order to elucidate at which levels of the models associations of variables with self-harm were impacting, variance was partitioned using method D of Goldstein (Goldstein, Browne, & Rasbash 2007). For a small number of variables the level of association could not be identified using this method.

FINDINGS

The mean daily rate (at ward level, standardised to 20 beds) of incidents of verbal abuse was 2.41 (sd 1.40), aggression to objects 0.48 (sd 0.21) and physical violence to others 0.33 (sd 0.14). These variables were strongly inter-correlated, with spearman correlation coefficients of 0.72-0.76 at ward level and 0.31-0.37 at shift level.

Significant univariate associations of the three types of aggression with other variables are displayed in Table 1. The three multilevel models are shown in Tables 2-4, with the left middle column showing the separate analyses by each domain (e.g. patient variables, service environment, physical environment, etc), the right middle column showing the final analysis that results when all the significant variables from the domain analyses are combined in a single multivariate model, and the final column shows the level at which the identified associations occur (Trust, ward or shift).

A number of features of patients are associated with levels of aggressive behaviour in the univariate analysis, including the rationale for the admission being 'risk of harm to others', ethnicity, and indicators of social deprivation and fragmentation. However in the multilevel multivariate models, the one consistent association is between a high proportion of patients formally detained under mental health legislation on admission and high levels of aggression. This association is at the level of wards in all three models, indicating that wards within Trusts differ in their usage of legal powers and experience differing levels of aggression in association with this.

Within the service environment domain, only admissions during the shift showed a significant association in all analyses. Other variables failing to reach significance under this heading were the existence of various types of community support in the locality (assertive outreach, crisis, early intervention and home treatment services); and the availability of a Psychiatric Intensive Care Unit to which disturbed patients could be transferred. The level of association of this variable (Trust and ward) indicated that it was not that shifts within which a person was admitted were more likely to have aggressive incidents, but that wards and Trusts with high levels of patient turnover were likely to more generally experience more aggressive behaviours.

Although there were no univariate relationships with physical environment variables in the univariate analyses, the quality of the physical environment was inversely associated with aggression to objects, and the complexity of the environment, or the way in which it provided for easy observation of patients, was associated with verbal

aggression and physical aggression to others with greater complexity associated with less aggression. Patient routines tested for association with aggression were the holding of regular community meetings on the ward, and the numbers of planned patient activity sessions undertaken every week. Neither of these was associated with aggressive behaviours.

At a univariate level all other conflict behaviours were associated with all three types of aggressive behaviour, however this is likely to reflect in part differences between night and day shifts, and in part a dense network of interconnections between such behaviours. When these data are addressed with a multivariate multilevel analysis, many conflict behaviours still show significant associations. All aggressive behaviours were associated with a wide range of different forms of rule breaking on the ward, medication refusal, and all were associated with alcohol use by patients. However only verbal abuse was associated with substance use. Verbal abuse also differed in that it was not associated with actual absconding or self-harm. All these associations were mostly at the level of shifts, indicating direct connections, meaning for example that the same shift in which a patient consumes alcohol is likely to be the same shift in which an aggressive incident occurs.

Those containment methods measured at shift level showed a similarly high level of inter-correlation with aggressive behaviour for similar reasons. With respect to security policies, the intensity of restrictions placed on inpatients was positively associated with both verbal abuse and aggression to objects. These were ward level associations, reflecting the fact that such policies are generally determined by ward teams and did vary within the same organisation. The degree of searching of patients

and property taking place was inversely associated with aggression to objects, but not any other aggressive behaviour. This association was at the Trust level reflecting the central formulation of such searching policies.

All aggressive behaviours showed a significant relationship to door locking practices on the study wards. In the case of verbal abuse, this relationship was with door locking for part of the shift. As that association occurred at Trust and ward level, we can deduce that it was the policy of partial door locking (the door locked for some shifts or parts of shifts, and open at other times) that showed a positive relationship to the frequency of verbal abuse, rather than the within shift experience of the door being locked some of the time. Physical aggression against objects and others also shows a clear positive association with door locking across the board. The level of those associations was mixed, and they were exhibited variously at all three levels. Identifying the precise level of the associations for this variable was difficult, because formal and informal policy could exist at any level, and in this sample approximately one third of wards were always open, and one third always locked.

Seclusion was consistently positively associated with all three aggressive behaviours, even with verbal abuse when the frequency of more seriously aggressive behaviours were taken into account in the final combined model. The strength of this association was less for verbal abuse than for physical aggression to objects or others, nevertheless the association was still significant. The level of those associations was Trust and shift, with the Trust level association probably representing organisation-wide policies regarding seclusion, as well as its differential availability. The majority of the sample wards did not have access to specially prepared seclusion rooms at all.

In contrast, although manual restraint was associated with all three aggressive behaviours in the domain analyses, in the final combined analysis for verbal abuse this changed to an inverse correlation (more verbal abuse, less restraint) and for aggression to objects the correlation disappeared. Only for physical violence to others was there a robust relationship between manual restraint and aggression.

Both the univariate and multivariate analyses showed strong positive associations between nurse staffing numbers and aggressive behaviour. These were most consistent for numbers of qualified nurses on duty, and the level of these associations were at both shift and ward level, i.e. even individual shifts within wards showed higher levels of aggressive behaviour when more staff were on duty.

There were many associations between staff group functioning, attitudes and aggressive behaviours in the univariate analyses, with better team functioning (TCI), more positive attitudes to difficult patients (APDQ), lower burnout (MBI), and more order and organisation (WAS) all associated with less patient aggression. However these associations were not as prominent within the multivariate analyses, with only increased burnout showing an association with verbal abuse and aggression to objects, and order and organisation showing an inverse relationship to physical aggression to others. Even these relationships were not retained in the final combined analyses.

DISCUSSION

The main limitation of this study is the cross sectional nature of the dataset. The significant correlations reported cannot identify the direction of causality. Firm conclusions cannot therefore be drawn from these correlations, which are subject to a variety of different interpretations. However the large scale of the study, the precision of estimates of association yielded by a multilevel analysis, plus ability to identify the level of associations, are strengths of this design.

The positive association between staffing numbers and aggressive incidents was an unwelcome finding, as it would perhaps be preferable to find in inverse association between the level of nursing care resources and such adverse events. Our previous work has shown an inverse relationship between the presence of regular nursing staff and violent incidents (Bowers, Allan, Simpson, Nijman, & Warren 2005a;Bowers, Nijman, Allan, Simpson, Warren, & Turner 2005c), as has that of others (Chou, Lu, & Mao 2002;Lanza et al. 1994), and in surveys of staff or patients larger numbers are often seen as necessary to reduce levels of violence (FaganPryor et al. 2003;Kumar, Guite, & Thornicroft 2001). However one other study has also reported a positive association between staffing numbers and patient aggression (Owen et al. 1998).

Other research has indicated that mealtimes or other activity periods are high risk times for violent incidents (Depp 1976;Flannery et al. 1991;Kennedy, Harrison, & Hillis 1995), and that times when nurses and patients have to interact, such as during the provision of personal care, are potential trigger points for aggression (Lanza et al. 1991;Rasmussen & Levander 1996). This may indicate that interaction of any sort when staff and patients come together exacerbates the risk of incidents (perhaps due to patient symptomatology, irritability, agitation etc.). If this is so, then the

explanation for the association between more staff and more violence results from a greater likelihood of interaction between the two. As the associations we found were stronger and more consistent for qualified staff, it would appear that interactions between patients and staff who have some decision-making power, or who are enforcing detention in hospital, are more likely to be fraught and result in aggressive behaviour. This interpretation is supported by the association of aggression with rates for formal patient detention under mental health legislation, as formal detention adds tension and asymmetry of power to those interactions when they occur. Further support for aggressive incidents as interaction-driven is provided by the finding of a positive relationship between aggressive incidents and restrictions on patients. Those restrictions are enforced by staff through interactions with patients and are likely to be experienced as aversive. Rule imposition is a known trigger for patient violence (Mellesdal 2003), and patients sometimes feel that enforcement is unpredictable, harsh, critical, humiliating and punitive (Alexander 2005).

However there are also many other potential explanations for the staff-incident association. It could be that more staff led to more aggressive incidents being seen and reported on the PCC-SR at the end of a shift. However if this were so, positive associations would be seen between staffing variables and all types of conflict behaviour, but this is not the case. Analysis of this dataset in relation to incidents of self-harm has shown an inverse relationship with the presence of qualified nursing staff (Bowers, Whittington, Nolan, Parkin, Curtis, Bhui, Hackney, Allan, Simpson, & Flood 2007c). The second possible alternative explanation is that wards with higher rates of aggression may have more nursing staff allocated to them, in other words that the causal path is in the opposite direction. As these associations were found at shift

as well as ward level, such reallocations of staff could be at the level of staffing establishment policies (more staff allocated to wards where patients are known to be challenging), and at the level of shift be shift reallocation of nurses between wards within a unit (in order to manage aggressive patients). Another potential explanation is that at times of higher numbers, staff are more likely to intervene when rules are broken and/or patients are verbally aggressive, while in a context of low numbers they rely more on non-intervention and verbal de-escalation. It is therefore possible that the availability of more staff who are in a powerful position vis a vis patients (i.e. qualified nurses) triggers more aggression. Or possibly the greater number of staff available evokes more fear from patients, perhaps exacerbating paranoid thinking, raising levels of defensive aggression. Very similar considerations apply to the association found between ward observability and aggressive incidents. This could be through greater identification and counting of incidents when they occur because they are more likely to be seen, or it could be because a less complex environment facilitates more interaction between staff and patients, and that some aspect of that interaction in turn triggers aggressive incidents. We know from previous empirical studies that the physical design of ward environments modifies interaction patterns between staff and patients (Fairbanks et al. 1977;Willer et al. 1974).

Regrettably, dues to the cross sectional nature of the study, no firm conclusion can be drawn about which of these explanations are correct, and what proportion of aggressive incidents can be allocated to each potential cause. If the association is an artefact of workforce allocation policies, no action is necessary. If aggressive incidents are triggered by interactions per se, this runs counter to a long research tradition sampling staff (Altschul 1972;Cormack 1976) and patients (Rogers, Pilgrim,

& Lacey 1993) that descries low interaction rates, and calls for greater engagement and interaction with patients (Bowles et al. 2002;Cutcliffe & Barker 2002). However, some patients reportedly value nurses that display a 'benign non-intervention', using flexibility and tolerance to establish a therapeutic ambience (Rogers & Pilgrim 1994). If true, it suggests that nurses should engage in strategic non-interaction with patients who are judged irritable and likely to be aggressive, instead utilising an approach based on unobtrusive scanning and a general observation of the ward social environment (Hamilton & Manias 2007), only increasing their interpersonal involvement as patients' mental states improve. If the heart of the association is the link between rule imposition and aggression, or the utilisation of verbal de-escalatory skills, then greater or better focused training of staff is required to lower aggression rates.

Considerable anecdotal concern has been expressed about the use of illicit drugs by inpatients coupled with assertions that this can result in difficult to manage violent behaviour (Department of Health 2006;Sandford 1995). No association was found between substance use and aggression to objects or others in this study, probably because the most common substance consumed is Cannabis (Phillips & Johnson 2003), not noted for any connection with violence. Stimulant drugs are more likely to be associated with violent behaviour, but their use is rarer, and thus less likely to give rise to a discernible association within the data. Alcohol consumption was, however, consistently associated with violent behaviour, confirming the predominance of this problem as a trigger for violence in acute inpatient psychiatry as reported in a national audit (Healthcare Commission 2005). Strategies to contain or control alcohol consumption, if successful, are therefore more likely to yield reductions in violent

incident rates, and should be a higher priority than concerns about violent substance users.

Acute inpatient psychiatry in the UK is undergoing a period of flux in relation to the locking of wards. Over the past ten years increasing numbers of wards are permanently locking their doors (Bowers, Alexander, Callaghan, Eales, Guy, McCann, & Ryan 2002;Mental Health Act Commission 2005), however the impact of this on patient behaviours is relatively unstudied. The data from this study demonstrate a positive association between locking the door and aggressive patient behaviour. This evidence is strongest for physical violence to others. Verbal abuse rates appear to react to the uncertainty about whether the door will be locked, on wards where the door is only locked some of the time at the discretion of the nurses in charge. The association with aggression to objects may in part be patients protesting by kicking or otherwise hitting the door, breaking it open, or breaking other fittings such as windows in order to get out. Physical violence to others cannot be explained in the same way. Direction of causality is still an issue, and it may be that wards with higher levels of violence are more likely to lock their doors. However in order for this to be so, it would have to be a direct response to physical violence to others and aggression to objects alone, not verbal abuse. Analysis of the dataset in relation to self harm shows a similar positive correlation with door locking (Bowers, Whittington, Nolan, Parkin, Curtis, Bhui, Hackney, Allan, Simpson, & Flood 2007c). It is also possible that as well as heightening irritability, locking of the ward door creates tense dialogues between staff and patients when patients ask to leave, thus in some cases triggering violence. On locked wards a significant number of violent incidents are known to occur near the ward door (Nijman et al. 1997).

The association of all types of aggression with high patient turnover and frequent admissions may indicate that such behaviours are increasing on UK psychiatric wards. For many years the number of acute inpatient beds has been declining (Appleby 2004;Muijen 1999), and the numbers of admissions increasing (Payne 1995). Given that the rate of admissions is positively associated with violence, this implies that such events must be increasing in frequency. A greater concentration on community care and shorter stays in hospital may be welcome, but it appears to come at the cost of more adverse and risky incidents on the wards.

Evidence that the psychosocial functioning of staff influences aggressive incident rates is present, but it is not strong. Aggression to objects and verbal abuse were both associated with burnout, but this may be cause, effect, or both. Some previous research has also found links between verbal abuse from clients and low morale or intention to leave the organisation (Sofeld & Salmond 2003;Sprigg, Armitage, & Hollis 2007). The level of order and organisation was associated with less physical violence to others, but once again direction of causality cannot be determined.

CONCLUSION

The findings show a positive association between staffing numbers and aggressive incidents, but there are many feasible explanations for this, including staff deployment policies, asymmetry of power and rule imposition difficulties, the potential of any staff-patient interaction to result in an adverse outcome when the

patient is acutely ill, and the general level of staff interpersonal skills. Further research is required to disentangle these relationships. Changing features of UK psychiatry, including increased patient turnover and the locking of ward doors, are likely to be exacerbating the problem of violence on acute wards. However those policies may have other benefits, such as increased community tenure and reductions in absconding rates. Alcohol rather than substance use is strongly implicated as a cause of violence on the wards, and priority should be given to developing policies and therapeutic interventions to reduce this problem.

Table 1. Significant univariate associations of aggression with other variables.

Variable	Mean or proportion	sd	Univariate assoc. with verbal abuse r	p	Univariate assoc. with aggression to objects r	p	Univariate assoc. with aggression to others r	p
Patient Domain								
Proportion of admissions with schizophrenia	0.32	0.15	0.205	0.017	0.142	0.099	0.161	0.061
Proportion of admissions detained under MHA	0.30	0.15	0.389	<0.001	0.330	<0.001	0.379	<0.001
Proportion of patients admitted for risk of harm to others	0.32	0.15	0.279	0.001	0.241	0.005	0.279	0.001
Proportion of admissions white	0.67	0.25	-0.074	0.393	-0.093	0.282	-0.215	0.012
Porportion of admissions Caribbean	0.11	0.12	0.092	0.288	0.116	0.178	0.256	0.003
Proportion of admissions Asian	0.07	0.07	0.110	0.202	0.176	0.040	0.114	0.188
Index of Multiple Deprivation	33.68	12.08	0.381	<0.001	0.277	0.001	0.339	<0.001
Social Fragmentation Index	0.55	0.64	0.188	0.029	0.071	0.413	0.186	0.030
Patient approval of containment	35.33	2.69	-0.162	0.060	-0.183	0.033	-0.157	0.068
Service environment domain								
Admissions during shift	0.35	0.65	0.037	<0.001	0.033	<0.001	0.031	<0.001
Physical environment domain								
No significant associations								
Patient routines domain								
No significant associations								
Conflict domain								
Smoking in non smoking area	0.82	1.64	0.269	<0.001	0.134	<0.001	0.106	<0.001
Refusing to eat	0.29	0.58	0.125	<0.001	0.068	<0.001	0.063	<0.001
Refusing to drink	0.13	0.43	0.081	<0.001	0.053	<0.001	0.049	<0.001
Refusing to attend to personal hygiene	0.42	0.86	0.206	<0.001	0.106	<0.001	0.093	<0.001
Refusing to get out of bed	0.22	0.61	0.130	<0.001	0.060	<0.001	0.053	<0.001
Refusing to go to bed	0.15	0.52	0.095	<0.001	0.057	<0.001	0.048	<0.001
Refusing to see workers	0.06	0.31	0.113	<0.001	0.082	<0.001	0.054	<0.001
Alcohol misuse (suspected or confirmed)	0.11	0.39	0.097	<0.001	0.063	<0.001	0.054	<0.001
Substance misuse (suspected or confirmed)	0.10	0.40	0.105	<0.001	0.058	<0.001	0.050	<0.001
Attempting to abscond	0.22	0.70	0.201	<0.001	0.161	<0.001	0.139	<0.001
Absconding (missing without permission)	0.10	0.36	0.072	<0.001	0.052	<0.001	0.040	<0.001
Absconding (official report)	0.06	0.27	0.055	<0.001	0.039	<0.001	0.027	<0.001
Refused regular medication	0.29	0.56	0.177	<0.001	0.099	<0.001	0.087	<0.001
Refused PRN medication	0.10	0.35	0.205	<0.001	0.162	<0.001	0.170	<0.001
Demanding PRN medication	0.37	0.83	0.131	<0.001	0.082	<0.001	0.055	<0.001
Self-harm (mean Bongar score)	0.21	0.95	0.018	<0.001	0.035	<0.001	0.029	<0.001
Containment domain								
Banned items	34.88	4.24	0.122	0.158	0.139	0.106	0.170	0.047
Restrictions on patients	16.79	3.20	0.158	0.065	0.287	0.001	0.206	0.016
Drug/Alcohol sensitivity and monitoring	20.60	2.44	-0.172	0.045	-0.096	0.268	-0.057	0.507
PRN medication	0.72	1.04	0.217	<0.001	0.161	<0.001	0.124	<0.001
IM medication (enforced)	0.05	0.22	0.162	<0.001	0.181	<0.001	0.244	<0.001
Sent to PICU or ICA	0.01	0.13	0.058	<0.001	0.073	<0.001	0.084	<0.001
Seclusion	0.02	0.19	0.090	<0.001	0.128	<0.001	0.161	<0.001
Special observation (intermittent)	1.70	2.40	0.087	<0.001	0.062	<0.001	0.034	<0.001
Special observation (constant with engagement)	0.35	0.73	0.117	<0.001	0.092	<0.001	0.091	<0.001
Special observation (constant without engagement)	0.09	0.51	0.043	<0.001	0.044	<0.001	0.043	<0.001
Show of force	0.09	0.44	0.290	<0.001	0.269	<0.001	0.319	<0.001
Manually restrained	0.06	0.32	0.227	<0.001	0.262	<0.001	0.401	<0.001
Time out	0.10	0.55	0.232	<0.001	0.202	<0.001	0.231	<0.001
Staff demographics domain								
Regular qualified nurses on duty	1.99	0.96	0.054	<0.001	0.029	<0.001	0.033	<0.001
Regular unqualified nurses on duty	1.55	0.99	0.031	<0.001	0.019	<0.001	0.025	<0.001
Bank/agency qualified nurses on duty	0.33	0.66	0.014	0.002	0.007	0.119	0.012	0.008
Bank/agency unqualified nurses on duty	0.65	0.90	0.080	<0.001	0.047	<0.001	0.034	<0.001
Student nurses on duty	0.33	0.73	0.046	<0.001	0.018	<0.001	0.018	<0.001
Staff group and attitude domain								
Mean Team Climate Inventory score	3.58	0.37	-0.184	0.032	-0.194	0.023	-0.084	0.328
Mean Ward Atmosphere Scale score (programme clarity and order and organisation)	6.58	0.92	-0.312	<0.001	-0.272	0.001	-0.212	0.014
Attitude to Personality Disorder Scale (total score)	20.22	1.55	-0.162	0.059	-0.182	0.034	-0.069	0.426
Mean Maslach Burnout Inventory Score (emotional exhaustion and depersonalisation)	11.80	3.49	0.202	0.018	0.218	0.011	0.190	0.027

Table 2. Multivariate models of verbal aggression

	Domain models				Final combined model				Level of effect		
	Odds	Lower 95% C.I.	Upper 95% C.I.	sig.	Odds	Lower 95% C.I.	Upper 95% C.I.	sig.	Trust	Ward	Shift
Patient											
Proportion compulsorily admitted*	1.074	1.018	1.132	<0.01	1.058	1.019	1.098	<0.01		x	
Proportion admitted for risk of harm to self*	1.050	1.004	1.099	<0.05						x	
Index of Multiple Deprivation*	1.100	1.041	1.162	<0.001					x		
Service environment											
Admissions during shift	1.024	1.016	1.032	<0.001						x	
Physical environment											
Index of ward observability*	0.947	0.906	0.991	<0.05					x		
Patient routines											
Nil significant											
Conflict											
Violence to objects	1.087	1.082	1.091	<0.001	1.076	1.072	1.080	<0.001			x
Violence to others	1.053	1.049	1.058	<0.001	1.042	1.038	1.046	<0.001			x
Smoking in a no smoking area	1.114	1.105	1.123	<0.001	1.103	1.094	1.112	<0.001		x	x
Refusing to eat	1.020	1.012	1.028	<0.001	1.012	1.004	1.020	<0.01			x
Refusing to attend to personal hygiene	1.035	1.027	1.043	<0.001	1.026	1.018	1.034	<0.001			x
Refusing to get up and out of bed	1.010	1.002	1.018	<0.01	1.010	1.002	1.018	<0.01			x
Refusing to go to bed	1.017	1.011	1.023	<0.001	1.020	1.014	1.026	<0.001			x
Refusing to see workers	1.020	1.014	1.026	<0.001	1.017	1.011	1.023	<0.001			x
Alcohol use	1.025	1.019	1.031	<0.001	1.027	1.021	1.033	<0.001			
Substance use	1.009	1.003	1.015	<0.001	1.007	1.001	1.013	<0.05		x	x
Attempting to abscond	1.048	1.042	1.054	<0.001	1.029	1.023	1.035	<0.001			x
Refused regular medication	1.030	1.024	1.037	<0.001	1.029	1.021	1.038	<0.001			x
Refused PRN medication	1.043	1.037	1.049	<0.001	1.036	1.030	1.042	<0.001			x
Demanding PRN medication	1.023	1.017	1.029	<0.001	1.009	1.001	1.017	<0.01		x	x
Containment											
Door locked < 1 hr	1.151	1.090	1.216	<0.001	1.113	1.054	1.176	<0.001	x	x	
Door locked 1-3 hrs	1.078	1.030	1.128	<0.01	1.055	1.009	1.104	<0.05	x	x	
Door locked more than three hours	1.061	1.004	1.121	<0.05	1.029	0.974	1.087	ns	x	x	
Door locked full shift	1.011	0.986	1.037	ns	1.015	0.990	1.041	ns	x	x	
Restrictions total*	1.071	1.026	1.119	<0.01	1.046	1.010	1.084	<0.05		x	
PRN medication	1.100	1.091	1.108	<0.001	1.070	1.062	1.079	<0.001			x
Given IM medication	1.036	1.030	1.042	<0.001	1.011	1.005	1.017	<0.001			x
Sent to PICU	1.011	1.005	1.017	<0.001							
Seclusion	1.015	1.009	1.021	<0.001	1.007	1.001	1.013	<0.05			
Intermittent special observation	1.044	1.034	1.054	<0.001	1.023	1.013	1.033	<0.001		x	x
Special observation continuous with engagement	1.033	1.024	1.041	<0.001	1.012	1.004	1.020	<0.01			x
Show of force	1.078	1.074	1.082	<0.001	1.034	1.030	1.038	<0.001			x
Manually restrained	1.021	1.015	1.027	<0.001	0.994	0.988	1.000	<0.05			x
Time out	1.037	1.031	1.043	<0.001	1.021	1.015	1.027	<0.001			x
Staff demographics											
Qualified staff	1.058	1.049	1.066	<0.001	1.028	1.018	1.039	<0.001		x	x
Bank and agency qualified staff	1.029	1.021	1.038	<0.001	1.018	1.010	1.026	<0.001		x	
Unqualified staff	1.014	1.006	1.022	<0.001						x	
Bank and agency unqualified staff	1.045	1.037	1.053	<0.001	1.017	1.009	1.025	<0.001		x	x
Student nurses	1.013	1.005	1.021	<0.001	1.016	1.008	1.024	<0.001		x	
Staff group											
MBI emotional exhaustion & depersonalisation*	1.054	1.006	1.105	<0.05						x	

*Variables entered at ward level, all others entered at shift level.

Table 3. Multivariate models of physical aggression to objects

	Domain models				Final combined model				Level of effect		
	Odds	Lower 95% C.I.	Upper 95% C.I.	sig.	Odds	Lower 95% C.I.	Upper 95% C.I.	sig.	Trust	Ward	Shift
Patient											
Proportion compulsorily admitted*	1.244	1.097	1.410	<0.001						x	
Service environment											
Admissions during shift	1.123	1.099	1.147	<0.001	1.068	1.043	1.094	<0.001	x		
Physical environment											
Environment quality*	0.881	0.785	0.989	<0.05					x		
Patient routines											
Nil significant											
Conflict											
Verbal abuse	1.443	1.424	1.463	<0.001	1.413	1.394	1.433	<0.001			x
Violence to others	1.083	1.075	1.092	<0.001	1.058	1.049	1.066	<0.001			x
Smoking in a no smoking area	1.130	1.103	1.157	<0.001	1.122	1.096	1.149	<0.001		x	x
Refusing to eat	1.024	1.002	1.047	<0.05							x
Refusing to go to bed	1.033	1.016	1.049	<0.001	1.043	1.025	1.061	<0.001			x
Refusing to see workers	1.027	1.011	1.044	<0.001	1.021	1.005	1.037	<0.01			x
Alcohol use	1.068	1.050	1.087	<0.001	1.074	1.055	1.093	<0.001	x		x
Attempting to abscond	1.052	1.040	1.065	<0.001	1.037	1.023	1.051	<0.001			x
Absconding (official report)	1.042	1.022	1.062	<0.001	1.042	1.020	1.065	<0.001	x		x
Refused regular medication	1.026	1.004	1.049	<0.05							x
Refused prn medication	1.090	1.075	1.105	<0.001	1.080	1.063	1.097	<0.001	x		x
Demanding prn medication	1.073	1.052	1.094	<0.001	1.045	1.025	1.066	<0.001			x
Self-harm (mean Bongar score)	1.047	1.029	1.066	<0.001	1.040	1.022	1.058	<0.001	x		x
Containment											
Door locked < 1 hr	1.425	1.185	1.713	<0.001	1.226	1.020	1.474	<0.05	x		x
Door locked 1-3 hrs	1.264	1.076	1.484	<0.01	1.183	1.009	1.386	<0.05	x		x
Door locked more than three hours	1.230	1.029	1.470	<0.05	1.242	1.046	1.476	<0.01	x		x
Door locked full shift	1.362	1.252	1.482	<0.05	1.246	1.143	1.358	<0.001	x		x
Searching total*	0.863	0.794	0.939	<0.001	0.886	0.822	0.955	<0.01	x		
Restrictions total*	1.215	1.115	1.325	<0.001	1.171	1.085	1.264	<0.001		x	
PRN medication	1.228	1.204	1.252	<0.001	1.101	1.077	1.125	<0.001			x
Given Im medication	1.129	1.113	1.144	<0.001	1.059	1.044	1.073	<0.001			x
Sent to PICU	1.034	1.019	1.048	<0.001					x	x	
Seclusion	1.067	1.059	1.076	<0.001	1.058	1.047	1.068	<0.001	x		x
Intermittent special observation	1.095	1.064	1.128	<0.001							x
Special observation continuous with engagement	1.112	1.090	1.134	<0.001	1.040	1.018	1.062	<0.001			x
Show of force	1.106	1.095	1.117	<0.001	1.012	1.002	1.022	<0.01			x
Manually restrained	1.041	1.031	1.051	<0.001							x
Time out	1.081	1.068	1.094	<0.001	1.039	1.025	1.053	<0.001			x
Staff demographics											
Qualified staff	1.162	1.128	1.196	<0.001	1.123	1.088	1.159	<0.001		x	x
Bank and agency qualified staff	1.079	1.050	1.109	<0.001	1.071	1.040	1.103	<0.001			x
Unqualified staff	1.047	1.019	1.076	<0.001						x	x
Bank and agency unqualified staff	1.129	1.100	1.158	<0.001	1.037	1.009	1.065	<0.01			x
Proportion of staff white*	1.254	1.078	1.458	<0.01					x		
Proportion of staff male*	1.154	1.042	1.278	<0.01					x		
Staff group											
MBI emotional exhaustion & depersonalisation*	1.172	1.057	1.301	<0.01					x		

*Variables entered at ward level, all others entered at shift level.

Table 4. Multivariate models of physical aggression to others

	Domain models				Final combined model				Level of effect		
	Odds	Lower 95% C.I.	Upper 95% C.I.	sig.	Odds	Lower 95% C.I.	Upper 95% C.I.	sig.	Trust	Ward	Shift
Patient											
Proportion compulsorily admitted*	1.298	1.145	1.472	<0.001						x	
Service environment											
Admissions during shift	1.120	1.089	1.151	<0.001	1.057	1.028	1.086	<0.001		x	
Physical environment											
Index of ward observability*	0.892	0.798	0.998	<0.05					x		
Patient routines											
Nil significant											
Conflict											
Verbal abuse	1.418	1.396	1.440	<0.001	1.342	1.318	1.366	<0.001			x
Aggression to objects	1.125	1.114	1.136	<0.001	1.092	1.081	1.103	<0.001			x
Smoking in a no smoking area	0.948	0.921	0.977	<0.001	0.959	0.929	0.989	<0.01			x
Refusing to eat	1.083	1.058	1.109	<0.001	1.079	1.052	1.107	<0.001			x
Refusing to wash	1.063	1.038	1.088	<0.001							x
Refusing to go to bed	1.033	1.012	1.053	<0.01	1.052	1.032	1.073	<0.001			x
Alcohol use	1.093	1.072	1.115	<0.001	1.104	1.083	1.126	<0.001	x		x
Attempting to abscond	1.069	1.055	1.084	<0.001	1.042	1.026	1.058	<0.001			x
Absconding (missing)	1.042	1.020	1.065	<0.001	1.030	1.010	1.051	<0.01	x		x
Refused PRN medication	1.145	1.129	1.160	<0.001	1.089	1.070	1.108	<0.001	x		x
Demanding PRN medication	1.029	1.007	1.052	<0.01							x
Self-harm (mean Bongar score)	1.060	1.039	1.081	<0.001	1.046	1.024	1.069	<0.001			x
Containment											
Door locked < 1 hr	1.603	1.323	1.943	<0.001	1.495	1.234	1.811	<0.001	x	x	
Door locked 1-3 hrs	1.317	1.101	1.574	<0.01	1.209	1.016	1.440	<0.05	x	x	
Door locked more than three hours	0.931	0.739	1.174	ns	1.110	0.893	1.379	ns	x	x	
Door locked full shift	1.166	1.053	1.292	<0.01	1.110	1.002	1.229	<0.05	x	x	
PRN medication	1.202	1.174	1.231	<0.001	1.090	1.062	1.118	<0.001			x
Given IM medication	1.168	1.152	1.184	<0.001	1.102	1.085	1.119	<0.001			x
Sent to PICU	1.040	1.024	1.056	<0.001					x	x	
Seclusion	1.074	1.063	1.084	<0.001	1.061	1.050	1.071	<0.001	x		x
Intermittent special observation	1.051	1.015	1.089	<0.01						x	x
Special observation continuous with engagement	1.138	1.113	1.162	<0.001	1.082	1.057	1.108	<0.001			x
Show of force	1.121	1.110	1.132	<0.001	1.040	1.028	1.052	<0.001			x
Manually restrained	1.087	1.076	1.097	<0.001	1.065	1.055	1.076	<0.001		x	x
Time out	1.062	1.045	1.079	<0.001							x
Staff demographics											
Qualified staff	1.217	1.177	1.258	<0.001	1.145	1.105	1.186	<0.001		x	x
Bank and agency qualified staff	1.116	1.082	1.152	<0.001	1.075	1.039	1.111	<0.001			x
Unqualified staff	1.049	1.017	1.083	<0.01						x	x
Bank and agency unqualified staff	1.142	1.107	1.179	<0.001							x
Staff group											
WAS order & org. and program. Clarity*	0.864	0.768	0.972	<0.05						x	

*Variables entered at ward level, all others entered at shift level.

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