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Predicting admission rates to secure forensic psychiatry services

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ABSTRACT

Background. The planning and development of secure forensic psychiatry services for mentally disordered offenders in England and Wales has proceeded independently within different regional areas. However, certain mental disorders, offenders, and offending behaviour are all more prevalent in geographical areas characterized by socio-economic deprivation and social disorganization. Failure to consider these factors has led to inadequate service provision in some areas and inequity in funding. A new model is required to predict admissions to these services as an aid to resource allocation.

Method. Actual admissions ($N = 3155$) to high and medium secure psychiatric services for seven of 14 (pre-reorganization) Regional Health Authorities, 1988–94. Expected admissions were calculated for each district using 1991 census data adjusted for under-enumeration. Standardized psychiatric admission ratios were calculated and a range of social, health status, and service provision data were used as explanatory variables in a regression analysis to determine variation between districts.

Results. Actual psychiatric admissions varied from 160% above to 62% below expected for age, sex, and marital status, according to patients' catchment area of origin, measured according to deciles of the distribution of underprivileged area scores at ward level. The most powerful explanatory variables included a composite measure of social deprivation, ethnicity and availability of low secure beds at regional level.

Conclusion. Admission rates to secure forensic psychiatry services demonstrate a linear correlation with measures of socio-economic deprivation in patients catchment area of origin. A model was developed to predict admissions from District Health Authorities and is recommended for future use in resource allocation. Identification of factors that explain higher admission rates of serious offenders with mental disorder from deprived areas is a priority for future research.

INTRODUCTION

There are varying levels of demand for health care services between different populations. This poses a major challenge to maintaining equity in provision of funding to meet local needs. Nowhere is this more apparent than in psychiatry where it has become increasingly clear that there are widely differing admission rates to in-patient services from different geographical locations and that these correlate with derived measures of social deprivation (Royal College of Psychiatrists, 1988; Thornicroft, 1991; Jarman *et al*. 1992; Thornicroft *et al*. 1992; Dekker *et al*. 1997; Glover *et al*. 1998; Madianos *et al*. 1999). But a relatively small subgroup of psychiatric patients with severe behavioural problems has had an additional and profound effect on the financial position of several Health Authorities in England and Wales, especially those in inner London (Guite & Field, 1997), due to the numbers of residents requiring highly expensive,

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secure psychiatric facilities, many in the private sector (Murphy *et al*. 1997). Questions have been raised over the adequacy of provision of secure forensic psychiatry in-patient services and the current Department of Health formula for resource allocation to meet the needs of mentally disordered offenders from these catchment area populations.

There are approximately 4000 secure beds in England and Wales for the treatment of mentally disordered offenders and patients who cannot be managed in ordinary psychiatric hospitals. These are in the three Special (high security) Hospitals and a network of NHS and private units which offer medium security. The majority of these patients are compulsorily detained under the Mental Health Act, 1983, following charges or convictions for violent, sexual, or arson offences. A subgroup are detained under civil orders following non-criminalized but highly difficult or dangerous behaviour. These services represent low volume/high cost care. Patients remain for long periods in these facilities and staffing levels are high. The average price of a bed in medium security is over £120000 per annum. Beds in Special Hospitals continue to be funded centrally, but the Health Authorities will commission these services in the future. A recent study in a Thames region demonstrated that purchasers for Inner City districts would be severely disadvantaged by such proposals. Admission rates to high and medium levels of security demonstrated a ten-fold difference at district level in treated prevalence rates across the region, correlating with social deprivation measured using the Jarman Underprivileged Area (UPA) score (Jarman, 1985), and suggesting that certain purchasing authorities had been underfunded (Coid, 1998).

This previous study indicated the need for further research on a larger sample than could be obtained from a single region and covering a larger geographical area. Our aim in the present study was to examine the pattern of admissions to secure forensic psychiatry services in relation to measures of social deprivation at both ward and district health authority level derived from the 1991 census using the Jarman UPA. We therefore studied the treated prevalence rates of mentally disordered offenders and patients requiring maximum and medium security from a defined geographical area comprising half of England and Wales over a 7-year period. Finally, we developed a model that can be used by planners to predict the level of service provision required in secure forensic psychiatric facilities for a district population.

METHOD

The study was designed to retrospectively record all admissions to secure forensic psychiatry in-patient services for the years 1988–94 from a representative range of geographical areas, including large urban, small town, and rural areas, and with a wide range of locations characterized by different levels of socio-economic deprivation. (See Table 2 for comparison of electoral wards included in this study and totals for England and Wales in different areas.) Forensic psychiatry services included the maximum security (Special) hospitals: Broadmoor, Rampton and Ashworth; and the medium secure services for seven of the 14 (pre-reorganization) Regional Health Authorities. Admissions for this study were included from North West Thames, North East Thames, South Western, West Midlands, Merseyside, North Western and East Anglian pre-reorganizational regional health authority catchment areas. During the study period, certain regional services did not have sufficient medium secure beds (most notably North East Thames) and many patients were sent from these locations to private hospitals or to other NHS secure units.

Data for these admissions were included in the study so as not to under-represent these catchment areas. The catchment area of origin was coded according to the patient's most recent address. Patients who were of no fixed abode became the catchment area responsibility of the District Health Authority where their index offence was committed but were excluded from certain analyses within the study.

Collection of data was carried out at a total of 18 sites; three Special Hospitals, 11 medium secure units and four private hospitals. Information on admissions to these services was obtained from the medical records offices at each location. There was no centralized register for each year of study in three medium secure services and it was necessary to obtain information for admissions records kept on wards and then to subsequently cross-check data in the

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central records office. For the Special Hospitals, medical records departments held information on all admissions. These had been computerized for the more recent years of study. Each service was visited by a researcher (N.K.) and an item sheet completed for every admission. A single patient could have more than one admission and an item sheet was completed for each of these, recording the sequence number during the study period 1988 to 1994. This included subjects who were transferred from one level of security to another (e.g. Special Hospital to medium secure unit). Although a patient may have been admitted to another service prior to 1988, if they were next readmitted during the 7-year study period this was recorded as their first admission. This method of coding allowed the data to be divided according to individual admissions and individual patients. However, subsequent examination of the data revealed important differences in the type of service provided by the medium secure units in different locations. Some demonstrated multiple re-admissions of patients, reflecting a supervisory role of a proportion of their discharged patients in the community. This pattern of service delivery was less apparent in certain medium secure services with the highest levels of demand from their catchment area populations, fewer medium secure beds, and which sent more patients for treatment in private hospitals (Coid *et al*. 2001). To control for potential bias from the disproportionate number of re-admissions to a small number of units, data analysis was restricted to first admissions only.

The item sheet completed on each patient recorded information on demography, the nature of the referral to the forensic psychiatry service, legal status on admission, and catchment area of origin. Criminal records were available for the majority of subjects in their case files. Further information was subsequently obtained from police records on patients for whom both accurate address at the time of arrest and previous convictions were unavailable in the case notes. A total of 150 admissions could not be coded for postal code, primarily patients who had been of no fixed abode at the time of their index offence. Postal codes were coded using the PAF on CD-ROM which was obtained from the Post Office. The codes used were those in operation in 1991, the same year as the National Census and middle year of the 7-year study period for comparison purposes. Criminal behaviour or behavioural disturbance leading to admission was also recorded, as well as previous criminal and institutional history.

Analyses were carried out only for first admissions to the forensic services during the 7-year period ($N = 3155$). For the purpose of the study, our intention was to impute a measure of relative socio-economic deprivation to an individual admission by using a UPA score for the residence of that individual, based on their post code. Higher values of the UPA score indicate increasing deprivation. Electoral wards derived from post codes were chosen as the base area of residence with the intention of obtaining a more localized measure of deprivation compared to district health authority level. Admissions to high and medium security were combined with the intention of constructing more robust regression models, but also because the two levels of security will both be commissioned by Health Authorities in England and Wales in the future according to catchment area.

As well as determining electoral ward, District Health Authority of residence was also determined on the basis of the patient's postcode and from this the total admissions for all District Health Authorities covered by the study were also calculated. A wide range of other data were available regarding the demographic, social and health status of these District Health Authorities, as well as some information on local service provision (see Appendix 1). It was then possible to examine the association of these variables with admission rates which acted as a proxy for service need.

There were 3116 first admissions from 96 District Health Authorities using postal codes and 39 subjects coded according to the location of their index offence. National admission rates by age, sex and marital status were then calculated based on the 1991 census data which had been adjusted for under-enumeration. These were applied to the age, sex and marital status structures of each district to calculate the numbers of admissions in each district that would have been expected if the national rates had been applied. The actual admissions can be compared with the expected admissions to produce an estimate of under (or over) utilization of services by residents of each District Health

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Authority. Actual admissions divided by expected admissions ($\times 100$) gave the age, sex and marital status standardized admission rates (SAR) to medium and high security units. Correlation coefficients were calculated for various independent variables with the SARs. These variables included a wide range of social, health status, and service provision factors, including the availability of beds locally in low security or locked wards. Based on the results of these analyses, a further multivariate regression analysis was then carried out to determine which combination of these explanatory variables best explained the variation of the SARs.

RESULTS

Standardized admission ratios and social deprivation

Between 1 January 1988 and 31 December 1994, there were a total of 3155 first admissions to maximum and medium secure forensic psychiatry services in England from the seven regions. No data could be obtained on 18 additional patients and 150 (5%) were of no fixed abode, or did not have sufficient details to obtain a postal code. There were no significant differences between those who could or could not be coded on any of the variables we studied.

Table 1 demonstrates the standardized admission ratios and numbers of observed and expected admissions according to deciles of the distribution of District Health Authority UPA score in 1991. This indicated that actual numbers of admissions ranged from 160% above to 62% below expected. There was a 7-fold difference in the SARs from the least to the most deprived decile.

Fig. 1 shows the relation between standardized admission rates and level of deprivation of District Health Authority level, demonstrating a linear correlation.

Classification of electoral wards of patient origin

Electoral wards from the seven health regions can be classified according to the Office for National Statistics classification of the health authority to which they belong. This includes six categories: rural areas; prospering areas, which are primarily the affluent areas surrounding London and the large cities; maturer areas, which are mostly the suburban boroughs of Greater London; urban centres; mining and industrial areas; inner London (Wallace & Denham, 1996). Table 2 shows the characteristics of the electoral wards included in this study according to this classification, according to the level of socio-economic deprivation. The Table shows that electoral wards classified as more deprived (being in the upper third of the UPA distribution of wards in the seven regional health authorities under study) are more likely to be in Inner London, an urban centre, or a maturer area. Table 2 also shows that the wards included in this study had a very similar distribution of family area types to England as a whole.

Correlations between actual and expected number of admissions

There were 3116 first admissions from 96 District Health Authorities, where residence had been identified from postcodes. Standardizing by age alone, the Pearson correlation coefficient between actual and predicted admissions was calculated as $r = 0{\cdot}32$. This rose to $r = 0{\cdot}38$ when standardization was performed by age and sex, and to $r = 0{\cdot}54$ using age, sex and marital status. The dependent variable for subsequent regression models was therefore an age, sex and marital status standardized admission ratio (SAR).

Correlation between standardized admission ratios and other variables

The values for each District Health Authority on 26 variables which were considered may have been associated with admission rates to secure forensic psychiatry services were then correlated with SARs. Strong correlations were found with (correlation coefficients): (*i*) indicators of isolation, percentage of single occupant households (0·51), percentage one parent families (0·76); (*ii*) indicators of poverty, percentage of households without a car (0·67), percentage of social class V (0·59), percentage unemployed (0·71), percentage unskilled (0·60); (*iii*) composite measures of deprivation: under-privileged area score (0·73); (*iv*) high population density, percentage overcrowded (0·44); (*v*) levels of mortality: standardized mortality ratio (0·52); and (*vi*) availability of alternative bed facilities in a low secure or locked ward: regional low secure beds ($-0{\cdot}39$).

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Table 1. *Admissions to secure services by UPA decile based on distribution of UPA by District Health Authority*

Decile of DHA (UPA distribution)		Age/Sex SAR (CI)	Admissions		Population
			Observed	Expected	
Least deprived	1	38·29 (31·01–46·76)	96	251	1588850
	2	50·82 (42·80–59·90)	142	279	1723067
	3	64·40 (55·82–73·92)	202	314	2001023
	4	83·64 (73·71–94·54)	256	306	1967573
	5	93·40 (83·82–103·78)	346	370	2381027
	6	55·86 (47·96–64·70)	178	319	1991311
	7	97·66 (87·68–108·47)	349	357	2260147
	8	108·66 (96·73–121·65)	301	277	1728350
	9	134·83 (123·11–147·37)	486	360	2052877
Most deprived	10	261·31 (243·23–280·39)	774	296	1685130
Total			3130	3130	19379407

SAR, Standardized Admission Ratio; UPA, underprivileged area scores; CI, confidence intervals; DHA, Distict Health Authority.

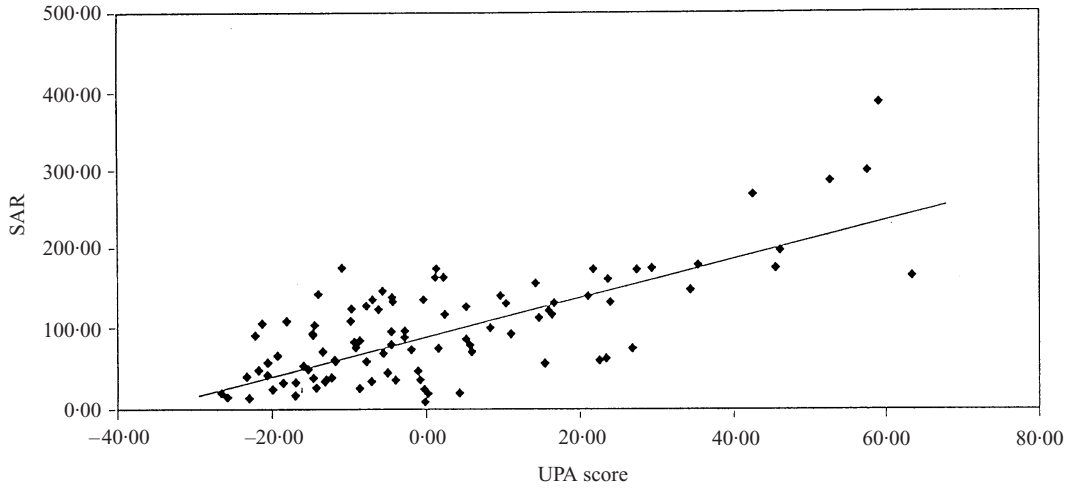


FIG. 1. DHA standardized admission rates by UPA deprivation score.

Table 2. *Distribution of electoral wards*, N (%), *among family areas by under privileged area score*

ONS family	Thirds of UPA distribution			Wards in study	All wards in England
	1 (low) *N* (%)	2 *N* (%)	3 (high) *N* (%)	*N* (%)	*N* (%)
Rural areas	745 (54)	637 (46)	349 (25)	1731 (42)	2880 (34)
Prospering areas	411 (30)	427 (31)	211 (15)	1049 (25)	2556 (30)
Maturer areas	87 (6·3)	158 (11)	327 (24)	572 (14)	1206 (14)
Urban centres	71 (5·1)	91 (6.6)	221 (16)	383 (9·2)	790 (9·2)
Mining and industrial areas	73 (5·3)	71 (5·1)	170 (12)	314 (7·5)	977 (11)
Inner London	0 (0)	3 (0·2)	110 (7·9)	113 (2·7)	186 (2·2)

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All the correlation coefficients above were highly significant.

Regression analyses

As explained above, the proportion of the variation between the actual number of admissions of District Health Authority residents which was explained by the numbers expected, based on population, age, sex and marital status structure, combined with national admission rates, was 30%. A stepwise regression analysis of the SAR was carried out to determine how much additional variation could be explained by the social, health status, and service factors that exhibited significant correlation.

The regression analysis used SAR as the dependent variable, and produced a model in which the following variables were found to be the strongest predictors: (*i*) a measure of deprivation; and, (*ii*) a measure of availability of low secure or locked ward beds at regional level. Details of the model, which explained 68% of the variation in SAR, are given at Appendix 2. The assumptions of a linear regression model were checked by analysis of the residuals and showed the model to be appropriate.

DISCUSSION

Admission rates over 7 years to secure forensic psychiatry services from an area covering half of England and Wales demonstrated important relations with a series of other social, demographic, health, and service provision indices that had been measured independently. Our analysis has provided a useful tool for identifying resource needs for these services in the future.

In the past, the planning of secure forensic psychiatry services proceeded independently within different regional areas. This was influenced largely by local managerial and clinical interests, and availability of resources, rather than according to a national strategy for mentally disordered offenders based upon an accurate assessment of the needs of local populations. Most medium secure services are currently located on the sites of mental hospitals that have closed or are running down to closure, usually at some distance from their major catchment area populations. The geographical remoteness of the Special Hospitals, their consequent problems of recruitment and retention of staff, together with their isolation from mainstream psychiatry, has been criticized (Murphy, 1992). The separate commissioning of high and medium levels of security has operated as a perverse incentive which prevents patients moving easily from one level of security to another according to their needs (James *et al*. 1998). Difficulties have been compounded for medium secure services serving the most socio-economically deprived areas by inadequate provision of beds and the consequent need to send patients to private hospitals at considerable distance from their homes and relatives, often in geographical areas with which they have little cultural affiliation. This reliance on referrals to private hospitals represents a 'double disadvantage' for specialist services in the areas of greatest need through a process of financial disinvestment. Not only has there been failure to develop comprehensive in-patient services, but this precluded development of the supporting facilities which might have prevented high rates of admission into secure facilities from these areas in the first place. It simultaneously created a culture of service-planning that was focused solely on tertiary referral in-patient facilities, ignoring any consideration of community provision or future strategies for prevention. The financial difficulties of some inner city health authorities are thus explained by the findings of this study.

Expenditure on forensic psychiatry services could only have been provided at the expense of services elsewhere. The study indicates that current plans for the health authorities to take over the funding of patients in high security will be unacceptable unless there is a new formula for resource allocation and our regression equation deliberately combined the two levels of security for this reason.

To redress the current inequity in funding and levels of service provision, this study has indicated that the number of admissions to secure forensic psychiatry services at district level can be predicted using a regression model that standardizes for the effects of age, sex and marital status. This model explains 68% of the variation in the standardized rates of admissions per district (see Appendix 2). The five-fold difference in crude admission rates observed across the areas studied was explained largely by differences in the health and social characteristics

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of the district populations, as has been previously demonstrated for admissions to conventional psychiatric services (Royal College of Psychiatrists, 1988; Thornicroft, 1991; Jarman *et al.* 1992; Thornicroft *et al.* 1992). However, two additional factors contributed independently. These included the availability of low secure or locked ward beds in local hospitals and a measure of ethnic origin. The best measure of availability of low secure beds appeared to be a value for the region as a whole. This performed better than individual District Health Authority values for these secure services in the model. Individual District Health Authority values may not have performed as well because many districts did not have low secure services during the study period, although there was a trend for an increasing number of District Health Authorities to develop these services in the later years. Admissions from the criminal justice system to local psychiatric services appear to be increasing (Beer *et al.* 1997). There has been recent expansion of low secure services occurring as a local reaction to perceived need, but not part of a coordinated strategy, and the precise number of these beds and data on their usage remains limited. However, a study of London psychiatric services suggested that considerable burdens are placed on local services when specialist forensic services are full and cannot admit difficult patients occupying beds in local psychiatric units (MILMIS Project Group, 1995).

The findings of this study demonstrate an interdependent relationship between admissions to different levels of security: when beds are available in local, low secure wards, there is less demand for beds in medium, and consequently high, secure forensic facilities. An alternative regression model is provided which omits the number of low secure beds at regional level, but which explains 53% of the variation (see Appendix 3). This would support the decision to combine admissions from high and medium security within this study for the purpose of developing this model. However, a limitation of this approach is that it ignores the fact that these security levels are managed independently and different factors may have influenced clinical decision-making regarding admission at each security level. Nevertheless, admission rates to high and medium security are correlated (Coid, 1998), suggesting that while processes influencing clinical decision-making may differ, the factors influencing demand for these services are similar.

The linear correlation we have observed between admissions to these services and measures of socio-economic deprivation indicate the importance of further research into the causal pathways between violent crime and severe mental disorder using an environmental approach. The association between urban areas characterized by social disorganization and high crime rates was observed in Chicago in the 1920s (Shaw & McKay, 1929), predating by more than a decade research into the same association with high admission rates for certain psychiatric disorders (Faris & Dunham, 1939). More recently, social disorganization theory has focused on informal control as the mediating factor between social disadvantage and crime. High levels of deprivation are considered to reduce informal control, thereby acting as a mediating factor between social disadvantage and crime, including violence (Sampson *et al.* 1997). Other researchers have emphasized the role of social decline and deterioration in the urban environment leading to social dislocation (Skogan, 1990; Wallace *et al.* 1992) and emphasizing the importance of local institutions in providing community stability, social control and alternative activities to occupy the time of residents (Wilson, 1996; Wallace & Wallace, 1997; Peterson *et al.* 2000). But whether these factors influence the behaviour of individuals with severe mental disorder to the same extent as the rest of the population, or whether other factors are more important, such as non-compliance with treatment and aftercare, together with substance abuse predisposing to violent acts following symptomatic relapse (Swanson *et al.* 1997), remains unclear. However, these identified risk factors are themselves more prevalent in areas characterized by social disorganization and may be compounded by inadequate psychiatric service provision.

It is of some concern that data for this study had to be collected at a range of different sites and that no central database currently exists to monitor the use of these expensive in-patient services. This is essential to guide the commissioning process in the future. However, inequity in resource allocation and the complexity of inter-relationships between different

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levels of security revealed by the study questions whether all Health Authorities have the necessary expertise to commission these highly specialized services. It may be more appropriate for commissioning to be carried out at a regional level in the future, taking into account the contrasts in health care needs of residents living in areas with high levels of deprivation relative to other areas than can be observed within a single region.

The formula derived from the regression analyses that can be used to calculate the predicted numbers of admissions to both high and medium security for a district are given in Appendix 2. We recommend that this model is used in future resource allocation for secure forensic psychiatry services.

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APPENDIX 1

Dependent variable

Marital status, age and sex standardized admission ratio

Independent variables

DHA SMR
NHS facilities per 10000 population
Psychiatric facilities per 10000 population
Medical facilities per 10000 population
PICU beds in DHA
PICU and learning beds in DHA
PICU beds in region
Psychiatric nurses per 10000 population
Community psychiatric nurses per 10000 population

1991 census derived variables

Jarman UPA score for DHA, as percentages
Aged under 5
Unemployed
Unskilled
No amenities
One-parent families
Overcrowded
Moved house
Ethnic minority
Share black population
Share white population
Born in Caribbean
Households with no car
Single occupant households
Social class III-M manual
Social class IV
Social class V

APPENDIX 2
FULL REGRESSION EQUATION

Model

$$\text{SAR} = 142{\cdot}7 + (2{\cdot}369 \times \text{UPA}) - (0{\cdot}742 \times \text{REGPICU})$$

	Coefficient	S.E.
Constant	142·7	8·1
UPA	2·369	0·11
REGPICU	0·742	0·19

$$R^2 = 0{\cdot}68$$

Where:

SAR = Standardized admission rates (standardized for marital status, sex and age) = actual admissions/expected admissions
UPA = UPA score for district
REGPICU = Number of low secure and psychiatric intensive care beds in region.

APPENDIX 3
REGRESSION EQUATION USING ONLY UPA

Model

$$\text{SAR} = 95{\cdot}2 + (2{\cdot}373 \times \text{UPA})$$

	Coefficient	S.E.
Constant	95·2	4·7
UPA	2·373	0·23

$$R^2 = 0{\cdot}53$$

Where:

SAR = Standardized admission rates = actual admissions/expected admissions
UPA = UPA score for district.

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